On the Convergence of TA with Ethics in RRI

Nielsen, Rasmus Øjvind; Bitsch, Lise; Nielsen, Morten Velsing

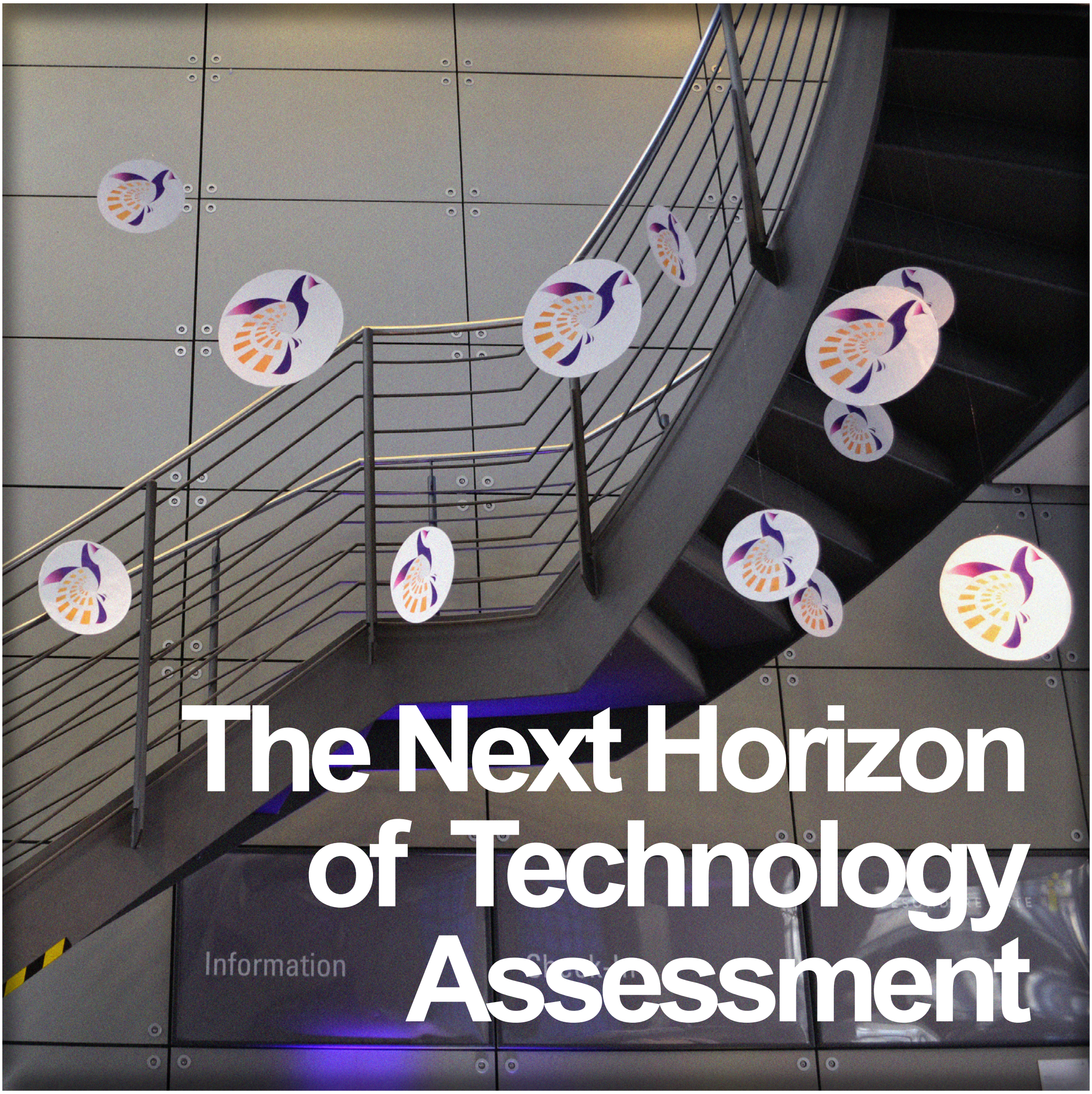
Published in:
The Next Horizon of Technology Assessment

Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
Nielsen, R. Ø., Bitsch, L., & Nielsen, M. V. (2016). On the Convergence of TA with Ethics in RRI. In C. Scherz, T. Michalek, L. Hennen, L. Hebakova, & S. B. Seitz (Eds.), *The Next Horizon of Technology Assessment: Proceedings from the PACITA 2015 Conference in Berlin* (pp. 81-86). http://epub.oeaw.ac.at/ita/pacita/pacita-2015-conference-proceedings.pdf

Proceedings from the PACITA 2015 Conference in Berlin



The Next Horizon of Technology Assessment

Edited by
Constanze Scherz, Tomáš Michalek,
Leonhard Hennen, Lenka Hebáková,
Julia Hahn and Stefanie B. Seitz

PACITA

THE NEXT HORIZON OF TECHNOLOGY ASSESSMENT

PROCEEDINGS FROM THE PACITA 2015 CONFERENCE IN BERLIN

PACITA

TECHNOLOGY CENTRE ASCR

ITAS Institute for Technology Assessment and Systems Analysis

The Next Horizon of Technology Assessment
Proceedings from the PACITA 2015 Conference in Berlin

Edited by
Constanze Scherz, Tomáš Michalek, Leonhard Hennen,
Lenka Hebáková, Julia Hahn and Stefanie B. Seitz

Graphic Design by
Iván Barreda and Tomáš Michalek

Cover Photo by
Tomáš Michalek

Printed by
INFORMATORIUM

ISBN 978-80-7333-121-4

Prague: Technology Centre ASCR, 2015

This publication was prepared as a part of the framework of the EU-funded
Parliaments and Civil Society in Technology Assessment (PACITA) project.
www.pacitaproject.eu

Table of Contents

Introduction

Constanze Scherz, Tomáš Michalek, Leonhard Hennen, Lenka Hebáková, Julia Hahn and Stefanie B. Seitz

With the horizon set to 2020, the European Union has identified the grand societal challenges for Europe's development in the coming years and beyond. Health and demographic change, clean and smart energy, green and integrated transport, climate change and resource efficiency, reflective societies, sustainable cities or the freedom and security of citizens are all issues that need to be tackled. In this situation, advanced and "better" science and technology are pointed to as the way forward. Yet, at the same time it has become obvious that the challenges are also caused by science and technology itself as decisive driving forces. It appears today that societal problems and their possible solutions are seamlessly interwoven with science and technology. Concepts such as Responsible Research and Innovation (RRI) aim to incorporate these linkages with the intention to consider possible social or ethical dimensions at an early stage of development. This intricate interconnectedness of science, society and policy making and the related decision-making problems are the central subjects of Technology Assessment (TA). TA as a concept of interdisciplinary, problem-oriented research, policy advice (such as parliamentary TA) as well as public dialogue and engagement (such as participatory TA) is intended to support society and policy making by understanding the problems related to the challenges and by assessing available options for managing them. The hope is to identify socially sound, "robust", resilient and practical ways of shaping the future.

It was the overall aim of the 2nd European TA conference, held in Berlin on 25 to 27 February 2015, the proceedings of which are presented in this volume, to take stock of and support the exchange on TA's perspectives of researchers, TA practitioners, policy makers and civil society organizations throughout Europe. This process had been successfully initiated at the 1st European TA Conference in Prague in March 2013 (Michalek et al. 2014). Both conferences were organized within the framework of the four-year FP7 project PACITA ("Parliaments and Civil Society in Technology Assessment"), with the Berlin conference being the wrap up and closing event of the project. Generally, the PACITA project and the conference define "Technology Assessment" in a broad sense. In this understanding TA comprises methods, practices and institutions for knowledge based policy making on issues involving science, technology and innovation, including TA-related fields such as Foresight, Science and Technology Studies (STS) and research on Ethical, Legal and Societal Aspects (ELSA) of science and technology. Both conferences tried to take up the thread of the brief tradition of European exchange on TA set by a series of meetings of the European TA community at the end of the 1980ies and beginning of the 1990ies (ref. introduction to Michalek et al. 2014).

The Berlin conference – as indicated by its title: "The Next Horizon of Technology Assessment" – was dedicated to explore TA's actual and future challenges and capacities. This in particular implies the role of TA (as well as related research and practice) with regard to the societal challenges as described in the EU's Horizon2020 program and to the challenge of setting into practice new modes of research and technology development as inscribed in the concept of Responsible Research and Innovation. Reflecting on respective capacities of TA not only includes insights into the scientific and technological developments involved (such as new and emerging technologies, ICT, or Ambient Assistant Living and service robotics). Besides analyzing societal debates, conflicts and problems of decision making it is also necessary to reflect upon concepts, methods and instruments to support democratic problem solving and decision making (such as sustainable development and consumption, public engagement, risk assessment, evidence-based policy making and communication). What kind of data, knowledge and dialogue do we need around decision making in our societies? What does it mean to support socially sound and robust ways of socio-technical development in terms of programs and projects, institutions and capacity building, methodology and knowledge transfer?

Topics Covered in the Proceedings

The conference touched on these and other issues in 50 parallel sessions which not only involved TA-practitioners and scientists, but also addressed the needs and interests of policy makers and parliamentarians in order to take account of TA's particular role as knowledge provider and process facilitator for decision making. The present book covers most of the papers presented and provides summaries of some of the special format sessions such as round tables and panel discussions.

TA and Policy Making

Aspects and problems of advising policy making are with no surprise subject to many of the sessions and papers. The Role of Research Evidence in Policy Making is explored with regard to the role of research for advising parliaments drawing on the long term experience of parliamentary bodies of TA as organized in the EPTA network. Another area of reflections is the selection of relevant and reliable indicators for policy choices of governmental bodies and for evaluation of policies. As indicators are central in framing policy problems the papers in this section reveal a need for more in-depth research on the workings of indicators in knowledge production.

Responsible Research and Innovation (RRI) in recent years has gained importance as a concept of science and technology governance. For TA – sharing a broad area of objectives and principles with RRI – it is decisive to explore RRI's role and potential for governance. Insights from innovation studies and from the history of political struggling with long-term or disastrous effects of technologies are applied in order to assess the concept's potential to foster democratic research governance. Approaches to define and develop RRI in terms of appropriate policy tools and instruments are presented. A specific challenge in this respect is to introduce the concept in industry and relate it to concepts such as corporate responsibility. Several papers explore the philosophical foundations of the concept of responsibility and its relation to ethics – seeing RRI as urging TA to shift focus from technological risks and impacts to normative concerns about the societal goals of innovation.

The role of public participation for democratic policy making is an ongoing issue of TA-discussions for decades. The papers in the chapter on Public Participation for Complex Policy Problems explore the political role and effects of participatory TA on different levels and contexts of decision making. The papers draw on experiences with stakeholder consultation on the European level or e-participation processes in national parliaments but also on participatory processes in local and regional planning processes (such as wind energy parks). Particular challenges for participation with regard to techno-sciences (synthetic biology) and in long-term planning (nuclear waste treatment) are addressed.

The chapter on Experiences with Early Engagement Activities addresses the possibilities and pitfalls of moving public engagement "upstream". Is it possible to open up the debate about technology development by early engagement of citizens in research and innovation? Or does it only lead to mainstreaming debates since there is no chance for empowering the lay-perspective early on in research and innovation processes (before distinctive technology applications are discernable)? This is the guiding question discussed with regard to TA for techno-sciences as well as participatory foresight activities.

Subject Areas of TA Practice

The bigger part of the book covers presentations directly out of the everyday practice of TA, i.e. presentations of results of TA studies on a broad spectrum of modern science and technology developments and related societal risks and opportunities, problems and debates. The scope of issues dealt with in conference session pretty well reflects what has been in the focus of societal and political debates on science and technology and consequently of TA practice in the recent years.

The global issue of climate change has led to intense debates on and accelerated activities to induce a change from fossil to renewable energy supply in Europe. The chapter on Responsible Research and Innovation for Energy Transition presents papers addressing the perspectives and problems of changing the fundamental mode of energy supply from the TA perspective. Two of the contributions are concerned with the options and problems related to the German decision to successively abandon nuclear energy and shift to a system of energy supply widely based on renewables. The institutional changes as well as the "responsible" innovations needed are explored and conflicts such as those about the extension of the electricity grid to distribute electricity from renewable resources across the country are discussed. Other contributions address the role of involving local citizens in measures of energy saving and discuss the needs for sound policy advice in the field of energy policy.

Aspects of the advancement of new technologies in health care have been addressed in three conference sessions – including issues such as Bio-Medicine, new technologies for elderly and for handicapped people, privacy issues related to new health information systems and the perspectives for the branch of Health Technology Assessment when confronted with emerging technologies. An overview of the discussions in the related conference sessions as well as selected papers is presented in the chapter Technology Assessment in Healthcare Practices. One of the papers gives a summary of insights from one of the outstanding attempts of the PACITA project to initiate Cross-European Technology Assessment projects and of a panel discussion on the perspectives for policy making in the field of “public health genomics” in Europe. The paper reveals the different policy approaches to the issue in European member states.

The problem of an ever growing amount of data processed on the internet and the opportunities and risks of retrieving and use them in a socially acceptable way is addressed by papers gathered in the chapter Governance of Big Data and the Role of Technology Assessment. The use of Big Data is seen by many as the new fuel for the economy. Exploitation of data on a scale or of a complexity that makes it challenging to process it with established methods (described by the concept of “Big Data”) is widely used or demanded for by governments and by business because it can provide insights into the behavior of individuals or populations. This on the other hand clearly includes a lot of ethical concerns and risks. Papers address the risks and opportunities as well as the related challenges for TA and governance and analyze the Big Data discourse around the thin line between overestimated expectations and underestimated uncertainties. It is argued that besides focusing at the sheer amount of data a specific challenge is set by taking into account the variety of algorithmic tools that help to make data a utility – be it e.g. in self-driven cars or credit evaluation.

The contributions to the chapter Opportunities and Risks Presented by New Technologies collect papers focusing on problems in assessing a variety of new and complex technologies. Salient in this respect again are issues related to the pervasiveness of the internet – including an exploration of the possibilities of using internet data for informing policy making. Other than in the section on Big Data, however, here the issue of security policies is in the focus: the trade-off between providing for public security and protecting privacy or the attitudes of citizens towards security measures – also in urban security management. Another contribution gives an overview of the proceedings of a specific session trying to assess the state of research on the expanding use and the future perspectives of the integration of robotics in working and private life.

TA Methods and Concepts

Self-reflection on why and how to do TA as well as on what are we actually doing and striving for in our daily practice is a must for a community claiming to significantly contribute to societal practices of knowledge production and decision support on complex relations of science/technology and society. The scope of the ongoing conceptual and methodological debates in TA is represented in this section of the volume.

Research and thinking about the societal impacts of technology change is nowadays established at many research institutions around the world. However, as a practice of independent policy advice TA is nowadays established mainly in Western Europe. Expanding the TA landscape is a long standing issue in discussions on ways of institutionalizing TA as a practice and it is quite clear that this implies to adapt the concept to a wide variety of socio-cultural contexts (Hennen/Nierling 2015). This is underlined by the contributions to

the chapter Varieties of Technology Assessment Practices. Different experiences of setting TA into practice are reported from Russia, South Korea, Poland and Portugal and a specific session was organized to discuss the different practices and perspectives of TA in East Asia. Issues dealt with in many of the contributions are the specific problems that TA is confronted with in transition economies, the options for building up TA capacities (e.g. by establishing respective PhD programs at universities) or the challenge of establishing links between policy making and academic TA practice. Finally, an approach to foster exchange on TA and provide for open access to the broad scope of TA studies around the globe is addressed by presenting an Internet Platform for TA.

How to deal with the fact that in early stages of technology development there is room for steering the path of development but only little knowledge about possible future technology effects at hand, whereas in later stages of development we know a lot but there is little room to maneuver left? This so called Collingridge dilemma is a specific challenge for TA as it intends to provide knowledge for policies to shape technology development in a socially sound way, a challenge that becomes particularly visible in debates on governance of techno-scientific fields such as nanotechnology or synthetic biology. The contributions to the session on Potentials and Challenges of Prospective Technology Assessment approach this problem from different angles by discussing how to sharpen and further develop TA’s prospective capacities despite the restrictions described by the Collingridge dilemma: Systematic anticipatory analysis of early stages of research and innovation, knowledge for selecting responsible research paths, concepts for inner-scientific participatory reflection are the central aspects discussed.

The section on Interdisciplinarity in Technology Assessment on the one hand comprise contributions dealing with the methodological and practical barriers and opportunities to integrate the needed broad scope of scientific disciplines – its bodies of knowledge and its different perspectives – in TA studies in a meaningful way, not only allowing for a broad scope of knowledge represented but moreover striving for a meta-perspective that can be instructive for decision making. On the other hand specific aspects of the inclusion of different knowledge spheres are addressed such as TA’s relation to ethics or the role of visions in technology policy and TA. A specific conference session was dedicated to discuss the relationship of TA and science journalism and to explore the options for improved cooperation.

With the richness of contributions given the present volume provides an up to date state of the art in Technology Assessment but as well indicates what is on the horizon for TA in the years to come. Roger Pielke – who gave a keynote at the conference – in the afterword of the present volume puts the issue of the “next horizon” of TA in perspective by reminding the TA community of the fundamental challenge and at the same time raison d’être of TA. He explores the role of “political myth” which he defines as fundamental, complexity reducing cognitive schemata for the mapping of the social world in political debates – as e.g. about innovation and the green revolution. He thus points at the need for and at the same time the possible pitfalls of independent provision of knowledge in policy making that lies at the fundaments of TA’s ambitions. Debunking political myth, as Pielke’s arguments might be read, necessarily implies to introduce other cognitive schemata reducing the complexity of the world.

PART I

TECHNOLOGY ASSESSMENT AND POLICY MAKING

THE ROLE OF RESEARCH EVIDENCE IN POLICY MAKING

Articles from the PACITA 2015 Conference Sessions:

The Role of Research Evidence in Improving Parliamentary Democracy

Caroline Kenny and Chris Tyler

Abstract

Parliaments perform an important democratic function in overseeing and scrutinising government, making new laws, and debating the issues of the day. Effective research use can ensure that policies are cost effective, ensure that those debating and scrutinising policy are informed by the best possible evidence, and scrutinise the work of government effectively. Yet, despite having a long history, little is known about how research is used in decision making. The ways that research feeds into parliamentary processes were examined in a recent session organised as part of the 2015 PACITA conference. This chapter outlines two empirical examples of work in this area: an analysis of two parliamentary debates and the work of an internal parliamentary research advisory service. However, gaps in knowledge remain. The chapter goes on to discuss a study being conducted, which is examining how research, of all types, feeds into parliamentary processes and the demand for such services from policy makers and parliamentary staff.

Introduction

The value of research for helping policy makers is now widely recognised (OECD 2015). Research can help policy makers to understand the root causes of societal challenges, assess policy options for addressing them, and evaluate the effectiveness of implemented policy responses. Many governments and international decision-making bodies now share a commitment to inform their policy decisions with the best available research. Millions of dollars are spent on funding relevant research internationally, and there is a rapidly increasing host of organisations focused on promoting and supporting the use of research in decision making. Yet, despite having a long history (Weiss 1979), surprisingly little is known about the extent to which research actually influences or is used by public decision makers in different contexts, or about which methods of providing research for policy-makers are most effective for improving that use under different circumstances.

One arena of public decision making that has been largely neglected within this discussion is legislative bodies (Tyler 2013). Although our understanding of research use within the executive functions of governments remains incomplete, these arenas have at least been increasingly examined over the last decade, particularly in sectors such as health (Gough et al. 2011; Graham et al. 2006; Nutley et al. 2007; Shaxson et al. 2013). In contrast, the role of research in shaping the democratic functions of parliaments

– debating the issues of the day, creating and revising laws, and examining and critiquing the actions of government – although recognised as important (e.g. Nath 2011; Padilla & Gibson 2000), has been systematically overlooked (Spruijt et al. 2014; Tyler 2013). There are important economic, moral and democratic reasons for focusing on this issue. Effective technology assessment (TA) and the use of research can ensure that policies are cost-effective and do not waste public money (for example see Scott et al. 2001). Morally, there is an imperative to inform those debating and scrutinising policy with the best possible evidence to ensure that those who intervene in other people's lives do so with the most benefit and the least harm (Oakley 2000). Examining and challenging the work of the government in part relies upon parliament's ability to scrutinise the evidence around policies and as such, there are important democratic reasons for studying the role of research in this arena (Goodwin 2014; Spruijt et al. 2014; Tyler 2013). As parliamentarians receive a significant amount of research advice from parliamentary staff and elsewhere, developing our understanding of how this advice influences these parliamentary functions is critical to improving our democratic institutions, and central to developing a comprehensive picture of the relationship between research and public policy.

Organisations Providing Research Advice to Parliaments

Thanks in large part to the work of the PACITA project and the European Parliamentary Technology Assessment (EPTA) Network, awareness and understanding of the different organisations providing research advice within parliaments across Europe has increased (Hennen & Nierling 2015). EPTA is a group of research advisory bodies that work with their respective parliaments via differing constitutional arrangements and processes. It includes two broad categories of members. The first category of EPTA members are internal offices based within parliaments. Examples include the Parliamentary Office of Science and Technology (POST) in the UK and the Office Parlementaire d´Evaluation des Choix Scientifiques et Technologiques (OPECST) in France. The second category of EPTA member are external offices that have constitutional relationships to their parliaments. Examples of this include the organisation TA-SWISS, which advises the Swiss Federal Assembly and the Rathenau Instituut, which advises the Dutch Staten-Generaal.

Although not a member of EPTA, one example of an internal research advisory body is the Scottish Parliament Information Centre (SPICe) research service within the Scottish Parliament. Established in October 1998, SPICe provides information on science, technology and engineering topics as part of a topically more diverse information service. The service forms one of the two broad teams which make up SPICe, the other being the information service. Those teams work closely together at a number of levels to provide a comprehensive research and information service to the parliament. The underlying purpose of SPICe is to ensure a well-informed parliament through the provision of accurate, impartial and timely research and information that helps Members of the Scottish Parliament (MSPs) to better scrutinise government and hold it to account, and which enhances the quality of decision making, legislation, debate and policy making.

The Use of Research in Parliament

Knowledge about the formal systems and services within and outside (but with constitutional relationships to) parliament go some way to addressing the economic, moral and democratic

obligations outlined in the introduction to this chapter. This is only one part of the puzzle however. There are many sources of research advice for parliamentarians that are not limited to organisations such as those within the EPTA Network. Most parliamentarians employ their own researchers and have access to the research functions within their own political parties. Intermediary organisations such as think tanks, social enterprises, and third sector organisations play a role (Guston & Sarewitz 2002; Pautz 2014; Sebba 2011, 2013; Smith 2013; Stone 2007; Williamson 2014), as do the media, businesses, academic institutions and other organisations (for example see Maynard & Evans-Reeves 2015). In short, there is no evidence to suggest that parliamentarians lack knowledge when it comes to decision making. What is missing, however, is evidence to show how these sources of research advice are used by policy makers in their parliamentary work and, within this, the effectiveness and impact of internal sources of research advice (as exemplified by the EPTA Network).

Projects such as the EU-funded Parliaments and Civil Society in Technology Assessment (PACITA) have done much to further understanding of the ways that research feeds into decision making. As Bütschi and Almeida in this volume show, research "offers useful tools and techniques" that can analyse the impact of different interventions and developments, engage a range of groups whilst also providing "a space for constructive dialogue and the generation of ideas on technology-related issues, allowing for common strategic thinking" (see also Bütschi 2012; Bütschi and Almeida 2014). Bütschi and Almeida explore and discuss the needs of policy makers regarding research advice through an analysis of two parliamentary debates that took place within the PACITA project. In these debates, policy makers considered TA policy advice and shared their expectations and visions. The analysis by Bütschi and Almeida shows that policy makers are all too aware that often the knowledge that they rely upon is not only fragmented, but also influenced by lobbyists and interest groups. It is for these reasons that the policy makers in these debates expressed "great expectations" towards research advisory organisations, such as those that are part of the EPTA Network, to provide them with independent and structured policy advice.

Relying upon research advice or TA institutions is not always sufficient however. An examination of six public controversies in the Netherlands has shown that while the use of research can enhance debate, it is not "trouble free" (Blankesteijn et al. 2014). Levels of public trust in science decline once it is used in part for policy-making purposes and science itself can be used to support very different positions (Tiemeijer & De Jonge 2013). It is in this light that the limitations of research should be acknowledged as well as its role amongst other sources of evidence such as public consultations and the views of stakeholders other than scientists.

Building on these empirical studies is a study being led by Dr Caroline Kenny at University College London and the UK Parliamentary Office of Science and Technology (POST). A core part of this UK ESRC-funded project is a systematic analysis of the role of different types of research in parliamentary processes. The study examines the types of research that feed into the UK parliamentary system and the ways in which this happens. It also explores the factors (processes, mechanisms and cultures) that shape whether and to what extent research is used, and the role of an internal research advisory organisation – POST – within these processes. This study will contribute much to existing knowledge in this area and it is hoped that the study will be extended across Europe to allow a comparative analysis of the ways in which research feeds into and informs parliamentary processes. A study of this type would not only strengthen international networks between different parliamentary and research communities committed to enhancing the effective use of research within public policy, but also develop a comprehensive understanding of the different mechanisms that can facilitate the use of research in parliaments and how these mechanisms operate under different conditions.

Conclusion

Although many governments and international decision-making bodies share a commitment to inform their policy decisions with the best available research, surprisingly little is known about the extent to which research influences or is used by public decision makers in different contexts, or the mechanisms that are effective in enhancing the use of research in decision making. Existing knowledge in this area is largely theoretical and a wide range of models, theories and frameworks have been developed and used to describe and inform research use. Empirical knowledge in this area has been primarily conducted outside Europe and in certain topic areas, particularly health. One arena of public decision making that has been largely neglected within the existing literature is legislative bodies.

The importance of understanding research use in parliaments is increasingly being recognised, both in literature and by policy institutions that are funding related networks and capacity building projects. This paper summarises existing knowledge about the role of research in parliaments and legislatures internationally. It outlines the work that has been done to describe the different ways that research advice is organised within parliaments and the factors that shape the design and operation of such structures. The chapter has shown, through an analysis of parliamentary debates, that that research can have an important role within parliamentary and legislative bodies to support their democratic functions of scrutinising and challenging the work of government, debating the issues of the day and creating and revising laws. However, it has also shown that the use of research in such processes is not without difficulties. The use of research by policy makers can create public distrust and it is not yet known how knowledge from research sits alongside knowledge from other sources including the media, intermediary organisations such as think tanks, and the views of different stakeholders as the public more generally. In discussing these issues, this chapter outlines a study being undertaken by POST to explore the ways that research of all types feeds into parliamentary processes. It is hoped that findings from this study will contribute to the development of a framework for future research that addresses the limitations of the existing literature and to further understanding about the ways that research influences parliamentary functions. Such a framework would encompass comparative empirical analysis of multiple parliamentary systems in order to develop a comprehensive understanding of how particular mechanisms can facilitate the use of research in parliaments under different conditions. In addition to strengthening international networks between different parliamentary and research communities committed to enhancing the effective use of research within public policy, such a framework would advance our basic understanding about how research informs decision making and provide practical suggestions for how current practices can be improved.

References: Page 411

Technology Assessment and Parliaments

Danielle Bütschi and Mara Almeida

Abstract

The chapter explores and discusses the needs of policy-makers towards technology assessment. It highlights the challenges policy-makers have to face when dealing with science, technology, and innovation and discusses how TA can address them. In particular, the current challenges of policy-making on science, technology, and innovation are being considered and the authors reflect on how technology assessment could meet them. The chapter is based on the discussions that took place in two parliamentary TA debates within the PACITA project, where policy-makers had the opportunity to consider TA policy advice and share their expectations and visions. Based on these discussions, the chapter calls for parliaments and other policy actors to foster the deployment of TA activities across Europe and develop synergies among TA or TA-like institutes.

Introduction

Looking back at the history of technology assessment (TA), parliaments and TA institutions are closely interconnected (Cruz-Castro and Sanz-Menéndez 2005). In the 1970s and 1980s, it were members of parliaments who made the first calls for technology assessment in Western and Northern Europe. At that time, science and technology were subject to vigorous public debates and parliaments needed independent and comprehensive analyses and advice, based on credible and scientific methodologies. Some 40 years later, these claims are still valid, even though the world we live in has changed. Public debate and controversies on science and technology seem to have lost intensity but, at the same time, the issues under debate are more global and complex, with information moving very fast. Moreover, science and technology are at the core of European innovation policies and economic development in a climate of global competition and financial crisis.

These developments force the TA community to reconsider its relationship with parliaments and society. This issue was at the core of the two parliamentary TA debates organised within the PACITA project.[1] Aim of these parliamentary TA debates was to initiate a dialogue between the TA community and policy-makers so as to build a common vision of the role of TA, while taking into consideration the shifts in science and innovation within the European landscape. For the PACITA partners, building such a common understanding was a necessary step towards further deployment of TA activities – focusing on policy-makers' needs – in Europe. In total, about 40 parliamentarians and policy-makers from all over Europe shared their views and expectations on TA with the TA community: what do they need and expect from TA, and how do they guarantee that TA activities actually fit their needs? These discussions proved that technology assessment is still an important instrument for policy-making on science and technology, and also gave valuable inputs on ways to consolidate the links between TA and parliaments and, as a consequence, strengthen and expand the TA landscape in Europe.

Connecting the TA Approach to the Parliaments' Needs

Parliaments have to take decisions and legislate on technological issues of various kinds. They may regulate the development and use of technological innovations in order to mitigate risks or prevent abuses, but also set the framework for technological innovation to achieve specific – e.g. health, environmental, or energy – policy goals, or to meet public concerns such as security, economic and financial stability, or employment. This requires policy-makers to achieve a comprehensive view on the issues at stake, taking into account the ethical, legal, and societal dimensions of science and innovation. But, as stated by several politicians, this rarely occurs, as parliaments mainly rely on fragmented knowledge often influenced by lobbyists and interest groups. Policy-makers have, thus, great expectations towards TA to provide them with independent and structured policy analysis and advice on innovation and technology-related issues. They also expect from TA to foster a constructive dialogue between politics, science, and stakeholders, and to provide the views of the general public through participatory methods.

Whereas the TA community developed a series of methods and tools to meet the expectations of policy-makers, producing results that match with their very concrete needs remains a challenge. Considering that politics is, almost by necessity, driven by power games and bargaining between different views and interests, members of parliaments may select information that supports their opinions and positions rather than using the inputs provided by a balanced, evidence-based, and comprehensive approach of the issues at stake. This reality has to be acknowledged by the TA community, in the sense that TA should deliver options for politics rather than solutions. TA can also offer dialogue platforms and thus take the role of a facilitator among conflicting interests or positions.

The different time scales between science and politics is another issue the TA community has to take into consideration in order to meet policy-makers' expectations. Matters requiring immediate or prompt decisions often arise without warning on the political agenda and, when this happens, policy makers are expected to react immediately, sometimes under societal or media pressure, or simply to react to crisis situations requiring rapid decisions. In such cases, policy-makers need quick and reliable advice, which is quite a challenge for technology assessment, which is scientifically rooted and usually works on longer-term perspectives.

Globalization of Science and Technology

More and more technology-related issues are currently discussed and regulated at the European level, or even at the global scale. For instance, the management of possible risks of nanotechnologies or the issue of climate change are governed by policies defined in Brussels or by international committees.

This move towards the global level is challenging for policy-making and for technology assessment. It challenges policy-making in that respect that parliaments have to deal with the global dimension of science and technology while at the same time having to decide on a national or regional constituency. And it challenges technology assessment in that it has to offer new forms of policy advice able to serve policy-making on a global and cross-border scale. Advances in this direction have already taken place with the creation of the Science and Technology Options Assessment (STOA) at the European Parliament and the European Parliamentary Technology Assessment (EPTA) network. However, many global issues still need local action, and may be viewed differently from country to country. Climate change, for instance, will be addressed differently across the world, as attitudes towards the environment or the economic situation of countries may differ. Other topics such as ageing society, which many countries have to deal with, need country-specific solutions, related to the national legal system and cultural characteristics. The cross-European projects that have been initiated within the TA community in the last decade offer an effective and innovative approach to reconcile the global scale of science and technology and the local scale of policy-making. Such projects enable policy-makers to look at issues beyond national borders and integrate global challenges into national policy agendas.

(Re)thinking TA

Since the 1980s, when TA was first established in Europe, the role of the state with regard to science and technology has evolved, which has challenged TA to consider new governance developments. For many decades, the role of the state has been to drive innovation while, at the same time, mitigate the possible risks by establishing safeguards and ensure products' safety and quality. However, current technological trends and developments have implications that go far beyond what the traditional state's regulatory tools can achieve. This is for example the case with nanotechnologies, for which a comprehensive risks assessment is barely possible given the resources that would be required (unavailability in terms of time and money to assess thousands of nanoparticles). New approaches to state's governance are thus being developed, shifting from mitigating possible risks (risk governance) towards innovation design as to avoid adverse impacts (innovation governance). In Europe, reflections about the evolving role of the state with regard to science and technology are taking place under the heading of "Responsible Research and Innovation" (RRI) and will certainly affect the kind of policy advice that technology assessment may deliver in the future (Grunwald 2011, von Schomberg 2012 and 2013, Gudowski et al. 2014). As a matter of fact, as the role of the state is shifting from risk governance to innovation governance, TA may not only contribute to policy-making by addressing the possible risks of new technologies, but it will have to develop and implement tools able to foster a sustained dialogue between research, industry, stakeholders, and parliaments at an early stage of innovation.

In the current context of financial constraints, most countries are facing economic difficulties and budget cuts making public resources required to establish TA practices scarcely available. This situation calls for institutional innovation for TA. Each country has to find a reasonable balance between the need for independent policy advice and what a TA unit and other existing institutions could contribute to the policy-making process. For instance, countries which are currently considering the establishment of a TA unit but face budgetary constraints, could contemplate creating a very small structure (based inside or outside the parliament), supported by universities, science academies, research agencies, or science foundations. Another option would be to rely on the work done by established TA institutions in other countries. Since many technological issues of interest to policy-makers are similar from country to country, some TA (or TA-like) organisations may "import" relevant findings made by other TA units and use them as a mean to start a national debate on the topic in question. According to the resources and TA-specific skills available, this option may be achieved by translating TA reports presenting, for instance, the state of the art of a scientific field or a meta-analysis of the chances and risks of a given technology, by producing policy briefs on the basis of existing work done by TA institutes abroad; or by initiating a larger process in which local policy-makers and relevant national stakeholders would be involved.

Conclusions

TA has evolved with time shifting from risk governance towards innovation governance to adapt to the new technological trends and developments which have the capacity to radically modify societies. As technological developments have the potential of having strong impacts on societies, it is very important that they are democratically debated both by parliaments and within the broader society to ensure that their implications are fully understood and evaluated. In this respect, TA offers useful tools and techniques able to analyse the impact of technological developments and engage relevant stakeholders (policy-makers, scientists/technologists, and the wider society). It allows the structuring of knowledge, information and views of stakeholders in an effective way, thus offering a platform where progress can be made. Besides structuring knowledge to support evidence-based policy-making, TA also provides a space for constructive dialogue and the generation of ideas on technology-related issues, allowing for common strategic thinking.

With the exception of STOA, TA activities are rooted within national contexts. However, scientific and technological developments are driven by global forces and they have implications beyond national borders. In that respect, TA should be able to create and operate in an environment that takes into consideration both the national (cultural, social, and historical) context as well as the European agenda, striking a balance between the skills and strategic needs of individual countries and of the European Union. This is of course a challenge for TA, but can also be viewed as an opportunity. In the case of countries which are currently considering the establishment of a TA unit but face budgetary constraints, the fact that their policy-making has to deal with similar issues as other countries offers opportunities for resource-effective ways of collaboration. Parliamentarians attending the PACITA parliamentary TA debates highlighted these opportunities and suggested the creation of a Europe-wide networking structure (a kind of "European TA association") where several partners would have the opportunity to work together on the same issue and eventually influence European policy-making while having specific activities targeted to the national politicians, experts, stakeholders, or citizens. This enhanced collaboration would not only be effective to contribute to national and European policy-making, but it would foster TA skills across Europe to support broad and long-term strategies for the development of science, technology, and innovation.

References: Page 412

Interactive Development of Indicators for Responsible Research and Innovation

Jack Spaapen

Abstract

While responsible research and innovation (RRI) is a topic attracting growing attention in policy discussions, governments are hesitating to develop serious policies. This article looks at one of the possible causes for this, namely the lack of robust evaluative instruments. Following the work of an EU expert group that was asked to develop an evaluative framework, it argues that RRI takes place in networks with partners from inside and outside academia, and that an evaluation should be the product of a joint activity of these partners. The group suggests a framework of eight RRI criteria and three indicator categories: process, outcome and perception indicators. The framework does not have fixed indicators, but instead can be filled from a large toolbox with indicators that best fit the context of the specific innovation process.

What is the Problem with Responsible Research and Innovation Policy?

The topic of responsible research and innovation (RRI) has been on the agenda of European and national governments for some time now. However, RRI has not yet been widely implemented in research and evaluation policies. The question is why that is the case, and if something can (or should) be done about it. One reason governments hesitate with RRI policy might be that they find it too demanding, too complex next to other policies they have introduced recently, in particular policies that aim at stimulating collaboration between research and industry. This at least seems to be the case in the Netherlands, where since 2012 the so-called top sector policy became one of the prime elements of governmental research and innovation policy.[1] This policy is so strongly geared towards economic growth and export and to the supportive role that scientific research can play in this regard, that a focus on the social, ethical and legal aspects of research and innovation – which is what RRI essentially is[2] – could be seen as incompatible. The topic does not appear in a recent government briefing about the upcoming presidency.[3] Innovation is a separate topic in that briefing though, but the main keywords surrounding it are 'growth' and 'jobs'. Another factor that does not help here is the fact that — while there are more or less accepted definitions of the concept of RRI — there is no consensus about what RRI entails in terms of elements to be included in policy and evaluation. To help clarify this issue, the European Commission appointed an Expert Group in 2014 "to identify and propose indicators and other effective means to monitor and assess the impacts of RRI initiatives, and evaluate their performance in relation to general and specific RRI objectives". I was part of the expert group, and what follows is an account of the path we followed to introduce a framework for the promotion and evaluation of RRI policy that will hopefully help in developing a responsible policy.[4]

The Development of RRI Policy: Agendas and Evaluation in a Network Context

Looking at the scientific literature and EU policy reports, the group found RRI to be a wide subject consisting of many different aspects, which makes it difficult to measure its impact. The group decided to take Von Schomberg's definition of RRI as a guiding principle because it paralleled ideas and experiences of the members of the group.

Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society) (von Schomberg 2011).

This definition is comprehensive and open, and it combines a conceptual idea with practical implications. Above all, it sees RRI in a network perspective. Responsible research and innovation, according to the expert group, cannot be the product of one (governmental) actor, and it cannot be strictly defined. It has to develop in a network of people and organisations who aim at working together on the basis of a set of shared principles, preferably guided by the RRI keys. RRI therefore is a contextual concept.

According to the expert group, given the faltering implementation of RRI in evaluation policy,[5] it would help to focus first on the development of agendas in RRI networks, and thus on the collaborative governance of these networks. How are RRI policies developed, what activities are organised and which targets are set? Since networks consist of various parties, each with their own interests, governance will be distributed. Therefore, the development of evaluation methods, arguably, has to be a distributed activity too. That is, stakeholders should be involved in discussions about the kind of indicators that best fit the specific R&D practices and goals. Evaluation experts involved in these discussions should have knowledge about contextual evaluation and the role of stakeholders in RRI processes.

The expert group further noticed that the current political atmosphere seems to open up for less hierarchical, distributed initiatives. In the Dutch context, for example, governance of the top sectors is left to collaborative arrangements in the sectors. And in the European context, we see a shift too. In the expert report on global governance of science (European

Commission, 2009), governance was described as entailing "multiple processes of control and management" and involving "directing or setting goals, selecting means, regulating their operation, and verifying results". However, 3 years later in the EU report about ethical and regulatory challenges (European Commission, 2012), the focus of governance shifted to reaching consensus in a network of relevant stakeholders. This development is of course reflected in the definition of RRI by Von Schomberg quoted above.

Distributed governance is based on the assumption of trustworthy relationships among all the stakeholders. Frameworks in which stakeholders can collaborate to that effect are developing at all hierarchical levels of the science and innovation system. The two aforementioned EU reports regard relations at high aggregation levels (between nations), but also national and local/urban level governments and other organisations are increasingly viewing governance in a network perspective.[6] However, while these frameworks offer opportunities, the awareness about the importance of RRI is still underdeveloped in many cases. Consequently, the first priority seems to be in raising the level of awareness in these frameworks, both in the sense of peoples' responsiveness to the RRI criteria and of the RRI "rules and regulations" within these frameworks.

How Can Indicators Be Developed for RRI?

When a variety of stakeholders realize that research and innovation processes are characterized by their collaborative efforts, and when they recognize that each of them has particular interests in this process, the goals and conditions for evaluation will have to be formulated in a way that is acceptable to all or most participants. On a high level of aggregation, there is usually a consensus about the goals and products to be evaluated (for example green transport, healthy aging), but this will not always be the case at medium and lower levels, where intellectual, organisational and financial options might diverge.

The model for evaluation in these intricate networks, therefore, should be flexible to the specific contextual circumstances and open to debate. The expert group therefore opted for a general framework that allows for a variety of contexts. The framework consists of eight RRI criteria and a variety of indicators for each of them, divided in three categories. The first six criteria are those used by the EU, the last two were added by the expert group. The three indicator categories are: process, outcome and perceptions. Process indicators regard activities that promote RRI and the effects that these have, i.e. outcome. Perception indicators represent how activities and outcome are perceived and received by relevant stakeholders and wider audiences. Hence the model also includes a column for key actors. The weight given to the various process, outcome and perception indicators for a given issue depends upon the nature of that issue. The model can be filled with indicators according to the specific needs of the different stakeholders. Indicators can be qualitative or quantitative. Indicators will be developed in collaboration with stakeholders and evaluation experts. The result is a toolbox from which one can choose, as shown in Table 1.

Criteria	Performance indicators		Perception indicators	Key actors
	Process indicators	Outcome indicators		
Public engagement	Citizen science projects	Documented research results	Public interest in research result	
Gender equality	Policies aiming at changing gender bias	% of women that are PI	Interest of the community in gender issues	
Science education				
Open access				
Ethics				
Governance				
Sustainability				
Social justice/inclusion				

Table 1: Indicator framework for responsible research and innovation. Examples of indicators are given to illustrate the first two criteria.

What is important is not only the technical aspect of indicators (such as their robustness or the availability of data) but also the question of fitness for purpose. When RRI is conceptualized in terms of the interface and interplay between research and innovation communities, indicators should express both the actions of partners/stakeholders and of process outcomes. And since the outcome is often a matter of long-term development, short- and medium-term indicators arguably will be more important than long-term indicators. The search for indicators of impact should also take into consideration the interactive character of most innovations, that is, they do not follow a linear pattern from basic research to application and use by society. Indicators should explicitly or implicitly refer to the iterative character of innovation. An additional value of the bottom up procedure that the expert group has in mind for indicator development will be the fact that if the stakeholders become the "owner" of the monitoring, they will be readier to accept this as a valuable instrument to improve their performance.

Additionally, the expert group understands innovation both in terms of the "scientific and technological advances" that Von Schomberg is referring to, and in terms of societal innovation, that is, in terms of new forms of organizing social relations between people and organisations. In other words, societal innovation in a broad sense refers not only to work, but also to politics, culture and the broad social sphere and includes for example social media, crowd funding or google art. The interplay between societal and technological innovation is becoming more and more a central issue in the RRI criteria. For example, the

replacement of people by robots in the health care system raises not only the immediate issue of employment but also wider questions of ethics, science education, sustainability, social justice and governance.

Examples of Good Practices when It Comes to the Development of RRI Indicators

Innovation is a long term iterative process, in which new ideas, products and services are developed by a dynamic group of stakeholders, which arguably might be very different at the start than at the end. Ergo, there is a need for indicators that fit into interactive approaches that do justice to the variegated contributions of the relevant stakeholders in the network. Government (and governance!) policies need to pay more attention to supporting the activities in these networks to optimise the outcomes, and consequently they also will have to reflect on their own role and responsibilities.

In developing such network-oriented indicators, it is useful to look at perspectives that have been developed over the last 10-15 years for the distributed governance of networks.[7] Furthermore, work in the field of science and technology studies can be helpful, in particular regarding the "new production of knowledge" (Gibbons et al. 1994, Nowotny et al. 2001), where knowledge production is seen as multi-actor, transdisciplinary, and socially robust. Formal and non-formal public–private partnerships have been in existence for decades, but now they seem to have become the main form in current funding schemes for research and innovation.

The expert group looked at various projects that aimed at developing societal impact indicators. In the FP7 SIAMPI project, for example, indicators are developed collectively and focus on so-called 'productive interactions' between research and stakeholders in three categories: 1. direct, personal interactions (e.g. joint workshops, protocols), 2. indirect interactions through media (e.g. joint articles, designs), and 3. material interactions (e.g. sharing infrastructure).[8] They also looked at social network and stakeholder analyses to develop ideas about parameters that work in heterogeneous networks. In developing RRI requirements, the group also considered that some indicators are likely to be more meaningful on a higher level of aggregation than others. For instance, "governance" indicators, or "public engagement" indicators are perhaps less meaningful on the lowest levels of aggregation, where indicators monitoring the development of "ethics" and "gender equality" policies are more meaningful (if only to raise awareness in the work space).

Conclusion

In sum, the main goal of the evaluative framework is to be flexible. The matrix consists of 24 cells that can be filled according to the specific needs of the project at hand. Some indicators are already available, while others will have to be developed. Some might be more useful than others, while some might be more robust than others. The most important thing is to find a way to develop a consensus among stakeholders about what to gauge and how to do this. The EU expert group did not offer a general prioritised list of indicators but instead suggested an exemplary way that can be followed by stakeholders (regional actors, universities and research institutes, civil society organisations, funding agencies, etc.) to tailor the indicators according to their own needs, goals and concerns. The group found at least around 100 possible indicators in the eight categories! When we looked at the level of individual RRI criteria, such as public education, gender equality or sustainability, we noted that each of these is subject to its own policy development, policy action and monitoring. To successfully implement and develop RRI as a cross-cutting principle of research and innovation policy, a limited set of indicators should be selected that should include indicators for all eight RRI criteria and that should exhibit a balance between process and outcome indicators. Rather than the emphasis being on ‘hard facts’, chosen because they are easy to quantify, to be fed into an illusory command-and-control mode of governance, it should be on information that is helpful in collaborative modes of governance, developing trust, best practices and mutual institutional change.

References: Page 412

Indicators in Technology Assessment

Passive Choices or Reflected Options?

Nuno Boavida and Stefan Böschen

Abstract

There is a lack of research on indicators in TA studies. But, there are several reasons supporting the need to address this omission: indicators are cornerstones of many TA studies, revealing the scope and quality of the problem addressed. They are not normatively neutral instruments for analysing problems, but they can frame problems and strategies for the solution of problems. They need to be transparent and thoughtfully selected to open alternatives and prevent unintended controversies; they require substantial reflection because conditions for their use may change significantly, and finally they can provide valid insights for TA about the policy process. Furthermore, this paper offers a heuristic model for analysing knowledge production within TA studies. This is done to improve the analysis of complex problems and structuring options for democratic decision-making. The model proposes a detailed explanation of the complete selection of indicators using transparent criteria and analysing the observables used or the ones which should be used or the ones not yet known. Finally, this paper provides insights into the discussion of the panel organized while addressing the question as to how we can acquire deeper and more comprehensive knowledge leading TA professionals to reflect on options in their studies.[1]

Introduction

Technology assessment (TA) deals with complex technology problems. Usually, a TA study includes a set of indicators to decipher such problems. The selection of indicators is a sensitive and critical procedure. On the one hand, indicators are used by actors in the field being analysed, who frame the problem in a way that corresponds to their cultural and normative background as well as to their economic and political interests. In these cases, the selection of indicators can entail options that are not neutral, trivial or even conscious, creating an implicit and sometimes controversial space for “indicator politics”. This can be easily underpinned by looking at the debates about the risks of smoking or the climate change debate (cf. Proctor/Schiebinger 2008). On the other hand, there are also TA experts using indicators to describe the problem and to evaluate the options for acting and decision making. As TA experts operate in a “relative distance" (Gloede 1992, p. 324) to the fields being analysed, they normally have to rely on the indicators used by the actors, but also to offer a critical perspective on these indicators and to evaluate whether they are appropriate or not. Furthermore, the set of indicators selected to decipher a TA problem also varies with the evolution of the debates. For example, the debate about risk regulation of chemicals changed from the 2000s as it was no longer only oriented towards the damage (with indicators of toxicity or carcinogenicity), but also to the so-called hazard indicators (with indicators of persistency or bioaccumulation potential) (cf. Böschen 2014, p. 42). Thus, the selection and evolution of indicators in TA studies is a sensitive and critical procedure that can reveal the scope and quality of the problems being addressed.

Therefore, indicators are to be seen as a cornerstone of any TA study, where they represent effect-related aspects of the problem. This centrality suggests that practitioners should reflect not only about their use but also about the non-use of indicators. However, this analysis is unfortunately not routinely done. Against this background, we would like to put the thesis forward that TA has to shift from passive choices to reflected options in the use of indicators. In fact, TA has to reflect more thoroughly on the logics of the construction and application of indicators to improve its own quality of expertise. This thesis will be presented in three steps of argumentation. First, we want to review some general challenges with regard to the use of indicators, mostly based on innovation studies. Second, we want to describe the challenges in the use of indicators in TA studies. Third, we offer a heuristic model to reflect on the construction and application of indicators in TA, relating it to the comments made in a recent debate about indicators. This model overcomes the existing limitations by aligning the non-scrutinizing use of indicators in two ways: first by improving the analysis of complex problems in a scientific way, and second by providing a more useful structuring of options for democratic decision-making.

Some General Challenges while Using Indicators

There are some problems that can arise from the use of indicators in general as well as some significant challenges specific to TA activities. Let us first identify the problems associated with the general use of indicators, before proceeding to the challenges they present in TA activities. The literature reveals three main problems related to the general use of indicators.

One of the main problems with indicators is related to the variety found in their definitions and construction. The variety is significantly contingent on the topic and on the objective of the study. For example, Heink and Kowarik (2010) revealed that other authors in the same specific field of ecology and environment had often used different definitions and different indicators. The variations found in the definition of ecology and environmental indicators were significantly dependent on the topic under observation, the objective and the intended final user (e.g. politicians, researchers, companies, experts, general public, and media). The authors also pointed out that none of the available definitions of indicators could cover the complete concepts the term can have within ecology and the environmental arena. Thus, the definition of indicators and the indicators themselves vary significantly with the topic and objective of each study. Another aspect with regard to these, so to say, technical challenges in indicator

constructions consists of problems associated with the aggregation of indicators in composites or indexes. In the science, technology and innovation field, there is academic discussion about the purpose and methodologies used to gather data and build these types of indicators (Godin 2008; Nardo et al. 2008; Grupp/Mogee 2004; Barré 2004). Grupp and Schubert (2010) argued that some composite indicators in innovation were not subject to extensive research and may present problems of confidence, comparability and overlapping. Nevertheless, scoreboards or composite indicators are often preferred by policy-makers, as they can function as strategic instruments to influence changes in policy and for communication.

The second type of problem relates to the general effects of the use of indicators. In brief, the use of indicators can produce general effects (e.g. fatigue, resistance, pressures, clashes), be subject to political influence, have an impact on users, and be a straitjacket to parts of society. Furthermore, the systematic use of indicators can impose a moral and an ethical behaviour through the silent assimilation of their implicit values and duties into society (Merry 2011). Some examples of these effects can be found in the systematic use of, for example, innovation rankings, school rankings, new public management prescriptions, and the European Commission's excessive deficit procedure[2] (cf. Dahler-Larsen 2013). In sum, innovation indicators can present dangers to societal coordination through their increased complexity, ambivalence of interpretation, de-contextualisation; they may present problems of confidence, comparability and overlap; and they may lead to 'shaming and blaming' of countries and to media oversimplification (Feller-Länzlinger et al. 2010; Grupp/Schubert 2010; Nardo et al. 2008; Grupp/Mogee 2004).

The third and last main problem is related to the potential for deception that exists in the use of indicators. This point becomes obvious when looking at the use of indicators as an evaluation method, e.g. for measuring the impact of research, innovation funding and policies. In fact, Kuhlmann (2003, pp. 137-9) warned against using indicators alone to perform these evaluations because they are not compatible with the tendency to pursue complex political goals. In fact, the evaluations should combine various social science methods with indicators. There are many examples where an incautious observation of reality led, through indicators, to misconception of phenomena. C. Freeman (1995) provided two examples of how quantitative indicators could not explain changes in innovation systems. In a first example, the author showed that comparisons of research and development (R&D) indicators were an inadequate method for explaining the Japanese institutional and technical changes in the 1970s and 1980s. In his opinion, these changes needed a qualitative description because the Japanese quantitative analysis erroneously identified a concentration in the fastest growing civil industries (e.g. electronics), with patent statistics showing a leading role at the world level. However, these measures of research and inventiveness did not explain how these activities led to higher quality new products and processes, to shorter lead times and to more rapid diffusion of different types of technology such as robotics. The second example came from the other side of the former iron curtain. According to Freeman, the former Soviet Union's commitment to greater R&D did not in itself guarantee successful innovation, diffusion and productivity gains, as the fall of the Berlin wall would prove.

Challenges Posed by TA Indicators: Some Basic Arguments

The use of indicators in TA activities presents challenges primarily related to selected epistemological questions. While using indicators some fundamental questions have to be addressed. An indicator is a tool to know something about a selected aspect of the social or natural environment. Therefore, while using a specific indicator one focuses one's attention on a selected aspect of the environment and ignores others. This leads to questions as to whether the existing indicators are contradictory or not, what can be known about a problem by combing all of the existing indicators, and what the limits of this knowledge are. But another part of the story also has to be taken into account. This is how indicators are used in the policy arena and what this means for TA as expertise. On a first sight a few challenges can be described, leading us to the necessity of having a heuristic model for reflecting about the use of indicators.

First, reflection about indicators is central to TA practitioners because problem-centred studies frequently rely on indicators to address relevant societal questions about technology (Barré 2001). For example, in a TA study about the potential and the impact of cloud computing services, Leimbach et al. (2014) employed indicators of the type of use in cloud computing services and of the type of cloud services to understand and explain the adoption and usage patterns of companies and consumers. Thus, indicators are frequently used as a conceptual tool for analysing real-world technological problems.

Second, indicators cannot be seen as a normative neutral instrument for analysing problems. Although indicators are tools for describing and analysing a problem methodically, their selection is everything but normatively neutral. It makes an important difference whether one looks at the CO2 footprint of a product or at the whole chain of different risk factors associated with a technology. Furthermore, a TA position strongly oriented towards the precautionary principle will also be expressed in the utilization of hazard indicators because they address possible harm and not only concrete damage (cf. Böschen 2014). Therefore, the selection of indicators is not normatively neutral and is driven by specific criteria used by the actors proposing a focused description of a problem.

Third, the description of complex problems and the strategies for their solution are heavily influenced by the use of indicators. For example, the use of an indicator of 'security of livelihood' in a sustainability problem introduces a specific description of a selected problem which is in this way placed as a key problem against which strategies for its solution are to be defined (cp. with regard to climate science: Petersen 2012). In another example, use of the indicator of toxicity as a central problem concerning the regulation of chemicals introduces both a specific description of the problem and a strategy to deal with it (cf. Böschen 2014). The use of indicators to provide a description and the classification of safety or precautionary strategies are interlinked. In many debates, the availability of specific problem-solving strategies organizes the problem context that is addressed through indicators (e.g. Garrelts/Flitner 2011).

Fourth, the selection of indicators needs to be as transparent and thoughtful as possible. In fact, the selection may not only lead to opening new alternative technology options, but may also trigger significant controversies between TA practitioners and stakeholders that are used to

a limited set of indicators. In fact, the group of stakeholders may be accustomed to framing the problem by using indicators according to their cultural norms and/or their economic-political interests. For example, the debate about the risks posed by nuclear power plants shifted in the moment the indicator of climate neutrality came in, because nuclear fission previously seemed to be a 'green technology'. In this context, the selection of a 'new' indicator can trigger controversy, because those associated with nuclear interests may tend to dismiss an indicator of climate neutrality linked to the specific risks posed by the production and storage of nuclear waste (as in the just published Eco-Modernist Manifesto; cf. Ecomodernism.org 2015). Thus, the selection procedure of indicators needs transparency and reflection in order to both open policy alternatives and reduce the room for unnecessary controversies.

Fifth, the selection of indicators in TA requires substantial reflection also because the selection criteria may differ significantly in different fields of work. For example, in a mature topic such as pharmaceutical policy there is a significant amount of accessible data, the political context is known, and the stakeholders and the policy impact are relatively easy to identify, although issues may continue (cf. Demortain 2011). In a field of emerging technology such as nanotechnology or synthetic biology, however, there is less information available, the field has a different and evolving political context, and it can involve unspecified stakeholders or consequences (cf. Torgersen 2009). Moreover, the use of indicators in established fields has to be continuously reflected as there might be changes in methodology or new empirical test settings relevant for uncovering possible harm or damage. Therefore, the transference of indicators in established fields to a new or different technology needs reflection, as the conditions can change significantly and/or changes in methodology or new relevant empirical test settings might be necessary.

Sixth and last, an understanding of how indicators are involved in policy-making can help TA practitioners to better adapt their analysis to the specific needs of policy processes. In fact, insights about the policy process can help to differentiate from scientific and business processes, to develop public participation practices and to improve scientific communication of findings. In this process indicators play a key role as they are the cornerstones of the problem description and therefore of the problem which is seen to be addressed politically (cf. Petersen 2012). Consequently, it is decisive to make the selection of the indicators used to describe a problem transparent as well as that of the ones which are not selected, because the selection heavily influences the description of the problem and the process of finding a solution. In this way, critical reflection of the use and non-use of indicators itself opens up a political space of selecting the appropriate description of a problem in relation to normative grounds.

Furthermore, against the background of the specific features of TA in policy as well as in politics, the importance of such a critical reflection on indicators for TA studies becomes significant. According to Bernard Reber (2006), TA in a policy analysis perspective has its own limitations, mostly related to the resources needed to facilitate the interaction between TA researchers and policy makers, as well as any time restriction on the collection, consolidation, and dissemination of results. It is often the case that the scientific staff of a TA organization lacks experience concerning the policy culture, although some staff members may lead double career paths and are trained both in the hard sciences and in policy-making, according to the author. In addition, scientific analysis and political action are also based on significantly different logics. Scientific knowledge is likely to be strategically used (or ignored) opportunistically in the negotiation of different policy-making interests. Policy processes also face significant demands for justification, especially in the media, which insist on being told the reasons after or before political actions, according to the author. Therefore, it is important to link these two different spheres of action. TA, and in particular parliamentary TA, has the comparative advantage of demanding deeper justifications for policies options and providing a structure where normative and scientific issues are granted a clearer voice (Reber 2006).

But, a transparent system for structuring knowledge is needed for this advantage to be visible. This is why a clear distinction has to be drawn between general problem descriptions (which are offered by indicators) and both their empirical foundation as well as their normative consequences. To proceed in this way, we propose to use a model built on three categories: indicators, criteria and observables (cf. Böschen 2014).

From Passive Choices to Reflected Options?

These three qualifiers of knowledge make it possible to reflect on the construction and use of indicators. They can be defined as follows. Criteria evaluate indicators against the background of the main cultural values or interests and can be related to the indicators' policy relevance, utility, analytical soundness and measurability, and other (un)conscious factors. Indicators represent an effect-related aspect of a problem which should be considered or solved. And finally, observables concretize indicators by providing specified methods for empirical observations or test strategies. Why should we proceed in this way? Our thesis is that this scheme allows clarifying the layers to which the different arguments or examples of empirical evidences are related. Therefore, it enables us to classify any sort of knowledge with respect to the description of a problem. Moreover, it offers an insight into the values seen as relevant for constructing the respective problem horizon.

What does this mean with regard to TA studies in a practical sense? With regard to the construction of TA expertise, any study needs a clear formulation of the initial problem. But, this formulation changes if one uses such a methodological model. This heuristic model should allow a transparent selection of indicators, their related criteria and the observables that describe the problem as a whole. Therefore, TA exercises should include space to reflect about the inclusion and the non-inclusion of certain indicators – which allows insights into the related criteria but also perhaps into the limitations of the available data. In addition and based on this reflection on strategies for using indicator, the analysis phase should include a reflexive process about the social, cultural and political consequences of the selection of indicators, before technology options are suggested and recommendations elaborated.

During the 2015 PACITA Conference, which is reported in this book, we organized a panel on "Indicators in Technology Assessment – Passive Choices or Reflected Options?". The

presentations were mostly located at the methodological level. In fact, three contributions intended to shed light on (1) how to measure societal impact on innovation activities (by Rainer Frietsch of the Fraunhofer ISI); (2) how to measure the effects of the introduction of requirements related to responsible innovation in the Horizon 2020 programme (by Jack Spaapen of the Dutch Academy of Arts and Sciences); and (3) how to shift the focus of indicators from the effects of emerging technologies to the triggers of their hazards to enable them to serve as early indicators of the future impact, such as production quantity, persistence and bio-accumulative potential (quality), release into the environment, ability to proliferate (e.g. genetically modified organisms) and mobility of nanoparticles in organisms and in the environment (by Arnim von Gleich and Bernd Giese of the University of Bremen). In a different way a fourth presentation designed a frame to create an indicator of integrity as a way of rehabilitating science and avoiding alienation by identifying secondary interests, such as ideology, administration, commerce or utility (by Ole Döring, Horst-Görtz-Institute, SIGENET Health, Charité).

Starting with the fourth presentation (cf. Döring this volume), the main argument was not only to establish integrity as an indicator, but also to outline the key aspects of such an indicator. These are mainly based on specific procedural prerequisites. For example, as "the typical complexity in matters of TA requires best utilization of academic and moral resources", an "open, explorative and discursive trans-disciplinary program" is needed. Moreover, he argues for a "targeted employment of indicators", which is seen in a "well considered collaboration of quality and empirical-metrical modes", and a "Pro-active definition of quality", i.e. one which takes a look on "science as process". These arguments are underpinning the need for a heuristic model, as we offered here, to support a process of science that is transparent with regard to the main perspectives (condensed in indicators), the main sources of empirical data (stylized as observables) and the values used (bundled in criteria) as the sine qua non step in such an analysis.

With regard to the other presentations, the interplay between the three categories of our heuristic model and the importance of this way of understanding was also observable. Rainer Frietsch's question about the measurability of societal impact on innovation focuses directly on the centre of puzzling questions about the problems of constructing an indicator under circumstances of difficult boundary conditions of data availability. As the aim of measuring the societal impact on innovation processes is to compare the innovation environment in different countries, the observables of such an indicator have to be constructed in a way that the data related to the observables selected are available in all the countries included in the study.

Arnim von Gleich and Bernd Giese showed how the two indicators for the early concerns "intensity of intervention" and "depth of intervention" can be used for precautionary measures. Here, the political decision-making process was of main interest. Specifically, as these indicators themselves are composed of different sub-indicators, this presentation shows how challenging in detail such an analysis has to be, while also having a clear strategy for defining and sorting the knowledge elements.

Finally, the study by Jack Spaapen offers an insight into the challenges of how to transform a political guiding principle (in this case, the one of 'responsible research and innovation' of the European Commission) into a valuable set of indicators. The construction of indicators themselves has to correspond to the main ideas of such a guiding principle, i.e. transparency and responsibility, while also serving as criteria. Therefore, a social process has to be designed that allows support to be provided to the scientists and administrators involved in each project and for feasible indicators to be constructed. One conclusion is that if the relationship between criteria and indicators is unclear, a procedural approach is needed to reflect upon the normative boundary conditions and their relationship to the demands concerning what has to be measured and whether the facts taken in to account are feasible with regard to the criteria.

This short analysis offers an insight into how the notion of passive choices in the use of indicators can be transformed into reflected options. This procedure is challenging as not only epistemological questions have to addressed, but also questions of designing suitable processes for constructing and selecting indicators and their related normative qualifiers (criteria) as well as empirical qualifiers (observables).

Conclusion

This paper argues that the use of indicators in TA needs further inquiry. In fact, the selection and evolution of indicators can reveal the scope and the quality of the problem addressed. We identify three main problems associated with the use of general indicators: the variety of definitions and constructions, the general effects of their use, and their potential for deception. We then advanced six main arguments to deepen this field of TA research: indicators are cornerstones of many TA studies; they are not normatively neutral instruments for analysing problems; they can frame problems and the strategies for solving problems; they need to be transparent and thoughtfully selected to open alternatives and prevent unintended controversies; they require substantial reflection because the conditions for their use may change significantly; and they can provide TA valid insights about the policy process. Furthermore, the gap in the literature of indicators for TA needs to be addressed with research on the procedures for selecting indicators and more debates about different experiences. The heuristic model offered here provides instruction for analysing knowledge production within TA studies, improving the analysis of complex problems in a scientific way, and structuring options for democratic decision-making. The model proposes the need for TA practitioners to explain their complete process of selecting indicators by using transparent criteria and analysing the observables that exist. The model also advises detailed transparency in cases where observables do not exist and cannot be obtained or overlap. In addition, the panel organized to discuss this topic at the PACITA conference confirmed the need for more contributions in order to debate the use of indicators in TA. Participants stressed the growing need for more investigations to acquire a deeper and more comprehensive understanding that can lead to reflected options by TA professionals in their work.

References: Page 413

Integrity as an Indicator in Technology Assessment

Towards a Framework to Connect Motivational and Organizational Extensions of Quality Assurance

Ole Döring

Abstract

This article explores the concept of "integrity" as indicator in TA. It proposes a conceptual framework for reducing the dependence on quantitative or formalistic indicators and increasing the significance of qualitative indicators. At the same time, it reports on an ongoing study of governance strategies concerning ethical and quality requirements in biotechnology, in Europe-China interaction, and in health-related research. This comparative analysis has been developed through Sino-European collaboration on the ethics and governance of health and life science-based technologies. This conception connects motivational and organizational extensions of quality assurance, as a professional program for self-cultivation under conditions of adherence-based governance.

Introduction

Technology assessment (TA) is a standardized practice for assessing the ways we construe, use, and relate to technology. A TA model depends on indicators that accommodate the meaning of such a model, that is, its purpose, its theory, and its methodological framework in practice. Can an ethical concept such as "integrity" be presented as an indicator in TA? This article introduces observations from an ongoing study of governance strategies concerning ethical and quality requirements in biotechnology, in Europe-China interrelations, and in health-related research. As part of a comparative and discursive investigation into Chinese/Confucian and European/Kantian conceptual frameworks in ethics that has been developed over two decades and through a series of studies about the ethics and governance of health and life science-based technologies, this emerging conception connects motivational and organizational extensions of quality assurance as a professional program for self-cultivation under conditions of adherence-based governance. It also circumscribes the structure of a research program.

Besides the empirical and conceptual parts of this approach, China is studied culturally, too, as we engage an explorative hermeneutic method to reading Chinese classical texts. The normative model thus established can benefit Europe because it introduces an unfamiliar but relevant reconstruction of the grammar of ethics, and it can benefit China because it encourages an interpretive framework of secular philosophy that China has neglected since it adopted the narratives of Western science and technology of the late nineteenth century, without adapting the cultural and social ramifications or the underlying grammar for making them meaningful under the conditions in China.

First, let us consider the meaning of the word "integrity". A preliminary assessment can take advantage of the apparent ambiguity of the term. It associates the virtuous attitude or characteristics of "being true to one's self" and "not be corrupted" with the technical understanding of integrity as a pattern of self-organization of functional structures. The latter appeals intrinsically to a technical imperative, namely the economic rationality of organizational efficiency. Hence, integrity can be defined as the effective interplay of technical and moral qualities that keep a purposeful system intact and whole.

Namely, the level of integration of the combined technical and moral designations can determine the teleology of such a system over time, as it mobilizes integrated learning and self-corrective functions. We shall take a closer look at how this can make specific ethical sense in the following.

Second, can integrity be extended to cover these qualities in cross-cultural transactions, persuasion, and intelligibility? This is an important concern in our time of multiple fields of globalization, especially in matters of TA, because ignorance about embedded conceptual apperceptions might generate cultural alienation. This refers not only to languages and social spheres, but also to the underlying levels of intellectual pre-formation of epistemic and moral structures.

After decades of dealings with different material and procedural principles in applied ethics, in particular in bioethics and medical ethics, I was reminded of a blind spot in the conceptual frameworks underlying the debates, or, perhaps rather a fundamental and biased perspective that has rarely been explicitly reflected upon. The established operational conceptions tend to be either formalized constructions of normative apparatuses that require sophisticated handling by specialists so as to become somewhat practical. They thus leave the zone between regulation and implementation empirically under-valued and under-complex, especially regarding questions of motivation or the collateral impact of technology in society. Or, they assemble an unconnected diversity of moral claims, subjective interpretations, different interests and languages, leaving us empirically disoriented in our efforts to interact trans-culturally towards practical guidance. The result then is a strong moral relativism. This constellation denies us a potentially helpful resource for mutual understanding as well as for progress in the matter. Instead, we can draw from the experience and insights that could result from integrating such a rich perspective and untried ways of expression into our discourse.

A Hermeneutic Case Study

The Zhongyong ("The Center and the Mean"), one of the Four Classical Texts, is a theoretical and practical exercise about the concept of cheng (誠) that is found throughout the classical political and moral canon and often translated as "sincerity" or "uprightness", and at times, as "integrity". This term has not received due appreciation in the current discourse because, like most of the traditional Confucian literature, it is not associated with the success story of Western science, business, and technology but with the discredited Imperial Chinese regime. Alternatively, it is misrepresented and obscured, owing to biased reading and lack of interest in a sympathetic ethical interpretation on the part of scholarly exegesis.[1]

Integrity is primarily a matter for individuals and institutions, namely to keep the self intact and uncorrupted under diverse and even adverse circumstances and extensions of one's moral character, as an expression of deliberate self-determination. Driven by the purpose to do the right things for the right reasons, it transcends and qualifies preference and submission according to overarching standards that include considerations of ends in themselves by owning them. Since the judgments about and the meaning of "right reasons" and actual "things" require justification and legitimation, reflections about integrity are intrinsically progressive, discursive, and dialectic. They reflect the "internal" deliberation of the subject or institution as an author of one's biography as a moral agent, of external behavior, and of social interaction.

Confucian integrity is interpreted as follows: "It is this very unity of integration and integrity that constitutes the genuine Confucian ethics".[2] This implies that the moral, internal motivational, and external structural features of good practice share a common denominator. In my approach, I take one step further by claiming that an ethically instructive concept of integrity, as in the texts of the Four Classics (Lunyu, Mengzi, Daxue and Zhongyong), already includes the notion of integration, by extension, namely as the performative mode of that same programmatic proposition. This rendering offers a method to transform the scope of the established sino-philosophical readings of Cheng that fail to account for its full intrinsic ethical potential that could benefit TA research and discourse. These would include the narrow translation as merely virtuous "sincerity" and hermeneutic frameworks that either ontologize, subjectivize, aesthetisize, or theologize the entire genre and are thus ill suited to grasp the full potential of Confucian ethics.[3] Especially the Zhongyong is conventionally assessed in a mystical or ontologizing manner, even in ethics.[4] However, what it tells us about learning and understanding requires what Gadamer has called a jump into the hermeneutic circle.

This understanding is expressed in Chinese with allusion to the doctrine of innate human moral capability. "Integrity implies that one has understood. Understanding implies that one has integrity" (誠則明矣 明則誠矣 , Zhongyong 23.2). The starting point hence is encouragement, to overcome the formal circularity through practice: the basic moral matter is simple and quite clear to humans, as reasonable beings. Here we find a deep connection between the different cultural formats of Kantian and Confucian ethics.

The following example from the Zhongyong is (my own) tentative translation, to confirm that integrity is the innate quality that allows everyone to make sense of good practice.

"There is a way to become a person of integrity. If one does not understand what is good, one will certainly not be able to grow integrity in one's person. Integrity is the way of Heaven. To act as integer is the way of humans. One who acts as integer, hits the mark effortlessly and succeeds without deliberation, one who maintains the proper form and thus keeps the middle of the Way, is a Shengren![5] One who acts as integer is someone who chooses the good and stays firmly on their way" (Zhongyong 22.3).

Integrity is that by which one becomes integer and the way one chooses to get there. Integrity is the end and the beginning of all things, without integrity there would be nothing. This is why the Confucian accomplished person, the Junzi, cherishes integrity, as the capacity for building a world according to reason. Through integrity not only does one establish one's self, by making one's self integer. It is that through which the "things" are established, too. To establish one's self is humaneness, to establish the things is knowledge.

Integrity is by virtue of human nature the way to integrate what is outside and what is inside. This enlargement process makes us integer, subjectively and objectively. (Zhongyong 26).

Integrity, in the sense of whole moral soundness, is not a mere concept but the genesis and progress of good practice in its epistemic properties and agency. It is a heuristic axiom, based on the postulate that it is indeed reasonable and communicable to want to be moral, and it is practical by being rooted not only in cognition but in performance, and it can be expressed verbally. It enacts the enlargement of self-cultivation perspectives, directed at different internal, social and worldly contexts.

It has self-generating and self-adjusting capabilities that drive the process of self-cultivation so as to express our potentiality in an unfolding sequence of sincere effort to do it right for the right reasons. Of course, we can choose to act against our cause of integrity or ignore its course. Then we are not who we are; departing from what our better understanding guides us leads us to be alienated from ourselves. Integrity is the quality that connects the most private and subtle acts of self-determination and hidden practice with our agency in our social spheres, in public, and in the workplace. Thus, integrity or cheng is the subjective realization and augmentation of autonomy, in the Kantian sense of self-legislation by reason, and freedom, as defined by our obligations towards others.

How Does This Notion of Integrity Help Us in TA?

Quality of science and medicine, trust in scientists, researchers, and medical personnel, the reliability of the systems of education and governance to provide for the best standard practice, the value of international science publications: each of these and all of them hinge substantially on the moral and professional qualities of individual actors and institutions. Trust in science and the self-governance capabilities of the science-technology complex is a vital condition for the sustainability of quality. However, whereas quantitative, objective, and positive legal mechanisms have been emphasized through the course of the spread of the biotechnology-bioeconomy-biopolitics clusters over the past two generations, the subjects' characteristics as scientists and

responsible citizens and the self-learning qualities in institutions to ensure that the promised value outcomes can be realistically achieved within the regulatory and motivational framework of the system have received relatively little attention. The question of what it means for the actor to want to play according to the rules is overshadowed by an apparent assumption that the objective definition of rules (such as ethics codes or legal norms) will somehow promote the corresponding practice in terms of the subject's decision as to how to interpret and enact them. Why would they?

In the meantime, some ill developments have been described in the scientific literature that result from fundamental, massive, and structural flaws in this system, affecting functionality and trust. Notably, this is of specific interest for ethics not so much in consideration of the legally defined faults, but in the special area of practice that depends on pro-active collaboration, which in terms of ethics is sometimes called "grey". The Lancet's debate on "increasing value and reducing waste "(Article series, January 8 and 15, 2014)[6] has a strong bearing on the integrity of science as a foundation for legitimate TA. The Lancet's strategy of calling for a "reduction of waste" could be advanced to a "rehabilitation of value" approach. Arguably, value in terms of quality has many codes but no explicit habitat in the currently dominant science system (Forschungs-Betrieb). Without science as the sovereign author of value, there is not even a sustainable measure for claims to quality.

The inability of the leaders of the scientific community to prevent premature and potentially harmful research and publications, in spite of a powerful established system of quality control and extensive lobbying, has just been prominently re-emphasized. The case of the use of "clustered regularly interspaced short palindromic repeats" (CRISPR) technology on human embryos, dubbed as gene editing,[7] provides a strong and timely example of the failure of a governance system that has been built mostly according to external control mechanisms and quantitative quality measures under conditions of economic pressures on the one hand and fundamental ethical disorientation on the other. The message for TA is to reconsider the foundation of the conceptual framework that continues to fail to address the essence of scientific quality production, starting with proper language: "editing" is a metaphor that obviously can have no meaning in genetics.

Rather than aiming to establish a pre-defined positive set of criteria for the assessment of technology, and as if technology were in essence a matter of engineering, this approach regards technology categorically as a practice, and self-reflected sincere language the key to integrity building. Accordingly, the performative dimension of technology should be scrutinized. Hence, cultural, social, and economic as well as individual motivational factors are considered when describing the form and content of quality indicators. Both the practicability of sincere intentions and the freedom to make conscientiously right (or wrong) decisions, as opposed to mere pragmatic or prudential incentives, are conditions for a responsible practice of producing and of assessing technology. To this end, integrity can be construed as a procedural and plastic regulative idea that serves as a principle and a virtue, to mobilize individual moral learning and institutional governance learning in terms of quality, primarily because it makes it reasonable for the individual actor/scientist to be co-opted by the system. It enacts a practical anthropology of responsibility, trust, and sustainability as a reasonable groundwork for quality development for human beings as scientists which is intrinsically connected with one's personal character.

What does it mean to use integrity as an indicator in TA? In a nutshell, cheng (integrity) helps us deal with the following eight stakes, as interconnected by one thread and jointly constituting the structure of the field of best practice competence. It strengthens the authority of science, as the captain of research; it highlights education as a conceptual and performative process to relate one's person to the meaning of quality in practice; it fosters quality control through honest open peer review in terms of epistemic incentives; it restores science's organization as it supports its disentanglement from nonscientific interests; it revalidates the economies of science, grounding its value in knowledge work with idealistic incentives; it reminds us to use moderate and self-reflected language when making scientific claims; it reascertains the conceptual framework of humanism as the moral and epistemic condition of science, in terms of sincerity, honesty, curiosity, and patience; it can then generate credibility as the standing of science in society. This field is accessible through integrity as a moral and functional capacity in a procedural and performative perspective, owing to the motivational, organizational and teleologic structure uniquely ingrained in the subject's agency.

This emerging conception, at the same time, connects the subject's extensions of quality production and quality assurance with a professional program of self-cultivation, offering a prospect for rehabilitation of value. It clarifies the foundations of scientific value as specifically qualitative. Namely, it is in principle out of the reach of quantitative definitions and the grasp of external descriptors. On this basis, neo-liberal strategies to conquer science as a venue defined by industries and markets fundamentally fail to yield quality in any sustainable sense. Without science as the sovereign author of value there can be no sustainable measure for quality claims and no pilot for adjusting learning processes in the field.

Cultural, social, and economic as well as individual motivational factors must be considered when describing the form and content of quality indicators. Epistemically and motivationally, education is our first consideration when advancing the self-learning capacities of the science system. Also, responsibility cannot be taken for granted but must be built; however, the authorities should refrain from narratives in a language of positive prescription (such as codes), because these are mere legal devices tailored for behavior, disregarding intent, that is, the very core of quality assurance. What can be referred to are (positive and negative) models of exemplary practice that reflect both the contingency of science in the social and economic entanglement and the practical options for proper action.

The wealth of experiences embedded in both the current and the traditional academic quality systems represent two extreme options for dealing with institutionalized professionalism in science. Traditional mechanisms for quality assurance according to subsidiarity within academia have failed to guarantee proper discipline among the responsible actors, giving way to free riders' attitudes and a corruption of the normative coherence, especially in the field of education. On the other hand, the externalization of control under the current regime has begun to systematically generate waste and harm regarding the legitimacy base of science. This trend is triggered especially in countries that historically lack a thick social embeddedness of scientific culture.

The practicability of sincere intentions and the freedom to make conscientiously right (or wrong) decisions, as opposed to mere pragmatic or prudential incentives, are limiting conditions

for a responsible practice of technology production as well as of technology assessment. As a consequence, it is imperative to mobilize individual moral learning and institutional governance learning in terms of quality process. The integrated, big and small picture, integrity-based approach should be adopted because it makes it reasonable for the individual actor/scientist to be co-opted by the system. This apparently tiny shift in the motivational structure can make the desired substantial difference regarding the quality of science, technology, and trust.

Outlook

According to the strategy sketched here, science can be rehabilitated as scientists own matter and property, within a subsidiarity system integrated through the moral, procedural, and organizational conditions of cheng or integrity. Such a system makes it resistant to the alienating impact of secondary interests, such as ideology, administration, commerce, or utility. It can also claim to be theoretically valid in Kantian terms of reason and coherence and practical according to Confucian experience.

Cheng 誠 or integrity can support science in generating robust indicators for TA that are defined by science not only formally but in essence and quality. Thus science is strengthened as a credible authority in a discourse about TA. The price of advanced integrity, however, might be tensions with the principles of the dominant system, i.e., utility, ideology, and marketization, and of course with the resisting powers of any institutional system, hence the loss of strategic short-term advantage.

Integrity described as a negative indicator, namely in terms of the absence of nonscientific controls, can yield a positive list of expected outcomes of responsibility. Every competent scientist knows at one point, by virtue of the code of reflection and ethics that distinguish him/her from mere researchers, when the line between best, acceptable science and bended science has been crossed. This is the starting point for growing adherence and a reference for a comprehensive reform of education and peer review.[8]

The typical complexity in matters of TA requires best utilization of academic and moral resources. Therefore, measuring integrity by standardized indicators requires a healthy culture of science, one that is emancipated, set on learning ethical, self-governed, and purpose-true – in a word, integrity. Methodically, such a system will be informed by an open program for continued institutional learning. In the hands of scientists as pilots of the work, we can benefit from a pro-active definition of quality. Science understood as a process that invites creativity, will not be suffocated by "innovation" through regulation and control.

Finally, it will sustain the concept of qualified trust in scientists, based on low-key intervention at the early stages of potential flaws or abuse. In a word, cheng or integrity proposes an integrated culture of ethics in science and medicine that builds agency and governance as a program for cultivation by learning for improvement. This enables both better technology and enhanced TA.

References: Page 414

RESPONSIBLE RESEARCH AND INNOVATION

Articles from the PACITA 2015 Conference Sessions:

(05) Responsible Research and Innovation – Governance and Policies
(08) Assessment of Knowledge Production in Responsible Research and Innovation
(12) Responsible Research and Innovation in Europe – First Lessons Learned
(13) The Future of Responsible Research and Innovation – Drivers, Barriers, Contradictions, Timelines and Scenarios
(15) RRI within Global Innovation Regimes: Producer Ethics, Consumer Freedom and Practices of Regulation
(31) Mobilizing TA for Responsible Innovation: Philosophies, Ethics and Stakeholders

The Art of the Long View

Reflections on a Future of Responsible Research & Innovation[1]

Elisabeth Bongert and Stephan Albrecht

Abstract

For many years there have been some fierce arguments over responsibility for the impact of scientific and technological innovations. Especially the long-term ecological and social risks, hazards and damages from so-called scientific-technological progress have again and again fuelled these arguments in many countries around the world. Prominent disasters ranging from the Silent Spring in 1962[2] to the Bhopal disaster in 1984,[3] the Chernobyl catastrophe in 1986 and the Fukushima Daiichi worst case scenario in 2011, to name just a few, have demonstrated that research and innovation, i.e. the use of new scientific knowledge, often have grave unintended consequences. All the more astonishing is the fact that up to today political decision makers and industrial executives as well as researchers and research officials do not tire of declaring that only technological and scientific innovation will secure prosperity and wealthy societies in the future. What is clearly lacking is reflection about the inherent relationships between scientific and technological innovations and their detrimental effects. The concept of responsible research and innovation (RRI), which was first proposed several years ago, claims to organize the criteria and procedures by which systematic and proactive research for unintended consequences shall become part of normal science. We will analyze the conceptual coherence of RRI, examine the barriers to implementation and venture an outlook at the future of RRI.

Core Elements and Dimensions of RRI

René von Schomberg, who can be dubbed as a founding father of the concept, stated that "RRI should be understood as a strategy of stakeholders to become mutually responsive to each other and anticipate research and innovation outcomes underpinning the 'grand challenges' of our time for which they share responsibility" (von Schomberg 2013, p. 51). Here we find a complex interrelation between:

- Stakeholders
- Comprehensive quest for R&I outcomes
- Grand challenges
- Shared responsibility

Grand Challenges (GCs) such as global poverty and hunger, public health, energy and transport systems, violent conflicts and wars, inclusion, demography and migration constitute complex constellations, many of them representing arenas, relations and conflicts with diverging interests and positions of power entrenched on all spatial levels from local to global over decades or centuries. The stakeholders include diverse branches of industry and utilities including their research and development facilities (R&D), departments of national and regional governments, funding agencies for R&I, big public research institutions and associations, universities, and civil society organizations. In many cases they pursue such different or conflicting agendas and interests that it is all but straightforward to negotiate and define shared responsibilities in view of the GCs. Even the comprehensive quest to determine the impact of R&I is a demanding piece of work as is evident from the history of technology assessment (TA) (Bongert/ Albrecht 2014). Von Schomberg declares that RRI *"is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)"* (von Schomberg 2013, p. 63, italics in original). The core dimensions of RRI thus include anticipation or foresight, reflection, deliberation and responsiveness.

There is a Season for Everything

Thinking about the possible future of RRI raises inter alia the question: Why "R" RI now? Has R&I been irresponsible or not responsible? Looking at GCs such as climate change, loss of biodiversity and fertile soil, or global poverty and hunger – which are all caused by human action or failure to act and which are shattering essential earth cycles as well as social systems – we can see two salient facts. The progress resulting from science and technological innovations, foremost in the OECD countries but meanwhile also in countries such as the PR China, constitutes a core driver for climate change and environmental degradations of all sorts on a global scale. Gains in efficiency and effectiveness of industrial processes are outpaced by the ever increasing amounts and cumulative effects. So the progress from R&I poses a paradox: when considered individually, the advances in R&I seem rational and within the law, while overall they result in circumstances and conditions which run against fundamental human rights, such as the right to water and food or the rights of future generations.

In 1992, the UN Conference on Environment and Development (UNCED) adopted the founding documents of the global politics of sustainable development (SD), inter alia the Agenda 21.

In paragraph 31 Scientific and Technological Community, it says:

- 31.7. Scientists and technologists have a special set of responsibilities which belong to them both as inheritors of a tradition and as professionals and members of disciplines devoted to the search for knowledge and to the need to protect the biosphere in the context of sustainable development.

- 31.8. Increased ethical awareness in environmental and developmental decision-making should help to place appropriate priorities for the maintenance and enhancement of life-support systems for their own sake, and in so doing ensure the functioning of viable natural processes is properly valued by present and future societies. (UN 1992)

In Para 35 Science for Sustainable Development it says:

- 35.2. The sciences are playing an important role in linking the fundamental significance of the Earth system as life support to appropriate strategies which build on its continued functioning. (UN 1992)

It is here clearly codified that the imperative for SD, i.e. the quest to secure a liveable future for our children and grandchildren, includes many and substantial transformations of human activities which even today have not proven to be sustainable. SD in this perspective is the normative umbrella for scientific work. In other words, whether scientific work and R&I is responsible has to be measured against the core criteria and dimensions of SD (Ott 2014). This is valid, nota bene, on a conceptual and theoretical level. In fact, since 1992 politics and corporate industry in most countries have not managed to kick off a great transformation in the direction of SD (cf. WBGU 2011), as is documented again by the final statement of the UN Conference on Sustainable Development (UNCSD) in Rio de Janeiro 2012. Important and powerful industrial actors even continue to negate the necessity for fundamental changes in production and consumption patterns as a prerequisite for the future functioning of the Earth system (Oreskes/Conway 2010).

From Program to Practice: Contradictions and Barriers

As we can observe in the politics of SD, opinions are divided, actions diverge, and actors are disunited. In a similar way, the concept of RRI faces contradictions and barriers. Let me just note a few here. First of all, the systems of reputation and recognition in scientific institutions still largely ignore the issues of the impact and responsibility of scientists. This is true of academia as well as of industrial R&I departments (though for different reasons). In the academic realm, special knowledge in more and more tiny parts of subdisciplines is required for a successful career, and simultaneously the fields of research and the results have to hold the promise of being applicable. All work, energy, and reasoning belong to the promises side of the research and not to the impact-side. This factor coincides with an entrenched division of moral and legal legitimation of scientific and technological innovations (STIs) between science-industry on the one hand and politics-society on the other. Whereas the former are concerned with delivering, the latter are in charge of compensating for every sort of impact, especially if it implies detrimental effects (for modern biotechnology cf. Albrecht 2006). This imbalance in the distribution of STIs costs and benefits is associated with a fundamental lack of democracy throughout science and technology policy. In nearly all constitutionally democratic countries parliaments play a minor role in shaping R&I agendas or in initiating national debates in respect to important technologies or technological innovations. And last but not least, the ubiquitous dogma and Procrustean bed of global competitiveness also present in science and technology policy matches with an absence of open, participatory procedures and deliberations about the long-term impact and the conceivable and achievable alternatives to proposed STIs. Though meanwhile many corporate executives and political decision makers talk fluently about the GCs and SD, they nevertheless abstain from changing the critical industrial, economic and political processes in favour of a transformation to SD. Thus the core programmatic dimensions of RRI such as foresight, reflection, deliberation and responsiveness must meet mental, institutional, and procedural opposition.

Conjectures on a Future of RRI

"People who try to peer into the future - both experts and laypeople - are very likely to start with an unreasonable bias in favour of the status quo" (Gardner 2011, p. 115). So we have to navigate between Scylla - an extrapolation of the status quo - and Charybdis - to indulge in wishful thinking - in order to present some well-founded conjectures on the future of RRI.

- In principle, a normative umbrella is needed such as SD and sustainability science (Clark, Crutzen/Schellnhuber 2004). As science and research are global human activities and globally communicated, it is imperative to reach a globally legitimized and accepted, globally applicable and just framework for RRI.
- As with all global agreements, a diversity of RRI approaches and procedures will be developed and implemented. Universities, funding agencies, research councils, governmental departments and ministries, and industrial consortia each need specific aims, procedures, and outcomes under the general umbrella.
- On the national and regional level such as the European Union a legal framework for core elements of RRI is needed.
- An important part of future RRI is the existence of solid funding and institutional structures. The time frame for funding extends from five years to permanent.
- The participation of citizens and civil society organizations (CSOs) needs special attention and specific tools in order to shape participation effectively and transparent.
- Institutions pursuing technology assessment and other science-technology-society research are predestined to monitor and evaluate comprehensively the practice of RRI, also by conducting comparative and international studies.
- The conceptual foundations and practice of RRI have to become an obligatory part of all curricula.

In the long view, RRI will have achieved a striking success when it is no longer a special set of norms and regulations but common practice in science as well as in businesses and politics.

References: Page 415

RRI and the Dynamics of Markets

Global Objectives Require Global Approaches

Arnd Weber and Ulrich Dewald

Abstract

The concept of "responsible research and innovation" is aimed at addressing "grand challenges", such as climate change, by achieving a joint responsibility among stakeholders regarding desirable products. In this paper, some insights from innovation studies are contrasted with the propositions raised in the discourse on responsible innovation. A range of substantial problems is identified when the restrictions of today's innovation systems are taken into account, such as: desirable products are difficult to identify, they are part of global value chains which are very difficult to analyse, they do not necessarily imply global sustainability, and to agree on responsibilities might collide with innovation routines of capitalist companies which need their business secrets in order to compete successfully. As consequences, it is proposed that technology assessments need to be integrated with instruments from environmental economics, and that ethics should increasingly be taken into account in global business processes and in consumption by the world's most affluent consumers.

Introduction

Objectives of RRI

The proponents of "responsible research and innovation" (RRI) attempt to align the direction of technological change with societally desired normative objectives, e.g. ecological and social ones, in order to address the "grand challenges". RRI plans to identify desirable, agreeable, risk-minimising products. This is to prevent later protests, such as those that took place against nuclear energy and GMOs (genetically modified organisms). The aim of RRI is to implement steering mechanisms along the entire innovation chain, from invention till market penetration. As von Schomberg (2013) put it, the concept addresses both publicly funded as well as privately financed research, for example research at Monsanto and BASF. The concept goes beyond traditional technology assessment (TA), which spells out risks, technical alternatives and policy options. TA typically was not involved in the actual design or innovation processes, with the exception of "constructive technology assessment", which is referred to as one out of a range of predecessors of responsible innovation (Stilgoe et al., 2013).

Approach of RRI

The approach of RRI is to run participatory processes in which stakeholders, including citizens and consumers, agree on a new type of product. In order to embed ethical considerations in actual technologies or products, the program of responsible innovation draws on earlier endeavours of TA (like the ELSA studies on ethical, legal and social aspects). Are the stakeholders, according to the concept of RRI, supposed to be responsible for the consensus once it is reached? Von Schomberg is not entirely clear on this. On the one hand he defines:

"Responsible research and innovation is a … process by which … actors and innovators become mutually responsive to each other with a view to the … acceptability, sustainability and desirability of the innovation process and its ... products." (p. 19)

This quotation does not mention or imply any responsibility of any participant. So one might think that the idea is that the stakeholders define a product which they believe to be agreeable because it is most likely not to harm any ecological or social objectives and thus to lead to a responsible development. On the other hand, von Schomberg writes:

"RRI should be understood as a strategy of stakeholders to become mutually responsive to each other and anticipate research and innovation outcomes underpinning the 'grand challenges' of our time for which they share responsibility."

As the sentence most likely does not mean that the stakeholders come to share and accept the challenges, the logic of this sentence links responsibility to the outcomes. It thus seems the author wants to say that all stakeholders share responsibility for the effects of future products. It remains unclear whether responsibility is meant in a legal sense. Perhaps it is not, but then this should be clearly stated, and the legal responsibility for effects be addressed. As the definition does not define who is responsible, the owners of the company designing a new product will remain responsible. We think that this is a weakness in the approach. The process, if implemented, would give the impression of a shared responsibility, while in reality this would not be the case.

Blok and Lemmens (2015) warn against the use of such rhetoric. In their example of a code of conduct which they investigated, they write that "...researchers and research organizations should remain accountable for the social, environmental and human health impacts of their work". Blok and Lemmens ask, "is being held 'accountable' deemed to have no consequences for the researchers? Then the stipulation in the Code of Conduct is just an empty play of words." The same applies to RRI; it is not clear what exactly responsibility means and what type of player is involved. And, to us it is largely unclarified to which authority responsibility is due if introduced in such a generic way. Especially this contextualization of responsibility is necessary, since otherwise the conversation on ethical concerns cannot be expected to lead to valuable outcomes (Grunwald, 2011).

In addition to the need for a thorough contextualisation of responsible innovation, we are confronted with problems arising around the focus on products and assumptions on the role that innovation plays for companies, which will be addressed in the next section.

Problems

We think there are several problems related to RRI which have not yet been taken into account sufficiently in the literature. We briefly introduce these problems in the following, while focusing on two areas of concern. The first involves problems around the complex nature of global value chains and product/design and process decisions. A second area can be seen in the role of innovation as an asset of companies. As to the first:

- It is difficult to define what a desirable and responsible product is. Typically, this is left to the market. Taking the example of cars, should they be regarded as irresponsible because of the number of casualties caused by motorized traffic? Should an electric car be desirable, without any regard to casualties, to the lifecycles of its components, or to the labour process in its factories? If the world had implemented a scheme for reducing carbon emissions, should a traditional car then be regarded as undesirable? Are busses desirable, and if so, what about shared taxis? This leads to the next problem.
- Even if agreement could be achieved regarding the desirability of a product, from when on will it become irresponsible if millions or billions of it get consumed? It must be anticipated that the uptake of environmentally sound products on global market scale will be associated with "irresponsible" turns. Take the bioethanol industry as an example. As this technology is ramped up and large areas of formerly untouched rain forest are transformed into mono-structured sugarcane cultures, responsibility assessment turns into a challenging endeavour. What is more desirable in the end: a favourable vision of non-fossil transport or an unspoiled nature? Responsible innovation needs to engage with such questions of upscaling responsible products. As technology assessments usually engage with the prospective evaluation of the possible future trajectories of a technology, this product-oriented turn implies a range of new questions for proponents of responsible innovation.
- Thinking in terms of global markets leads to another problem. Global value chains are very complex due to the international division of labour and nested competencies, which favour specific regional industries for operating specific segments of a value chain. If some responsible products were designed, how can undesirable side effects in global value chains be avoided? How can a product like a smartphone or an electric car, which contains hundreds of components, be evaluated under a concept like RRI? The question arises how responsibility can be distributed among the actors in complex value chains. Are new institutional practices needed which would mean a huge change to the functioning of the world economy?

We believe these questions have to be addressed seriously when taking RRI into account as an option for innovation governance. Taking the product dimension of RRI seriously inevitably would require a deep investigation of concepts of the firm, the organization of the capitalist economy and world trade, and the consequences of embedding desirable technologies and products therein.

The second area deals with the role of innovation in a market economy in which companies are strongly dependent on exclusive knowledge:

- In competition, companies need business secrets to surprise their competitors since they themselves might otherwise be surprised and lose their market. This is well known as "competition as a discovery procedure" or "creative destruction", in short, this is the dynamics of the market economy. In some cases, companies use patents to survive, and in other cases they simply keep confidential knowledge to themselves. These secrets concern new components or new processes whose characteristics differ from those used before. The new component might actually be produced by a supplier. So business secrets cannot be exposed to, for instance, consumers or ethical experts. One could conduct discussions with users, but companies cannot reveal the secret sauce, the production of which might involve all sorts of social and ecological consequences. So RRI processes are not compatible with market economies. One might think of creating an economy without business secrets, but after the failure of socialism there is little enthusiasm for such experiments.

Conclusions

RRI might be applicable for some new and emerging technologies, just as in the examples used by its proponents, in which entirely new classes of substances are discussed, such as GMOs or nanoscale components. For instance, Schomberg (1995) recommends that public discussion processes regarding GMOs be organised just like wage negotiations (p. 196). However, these are very special cases, and public discussions about potential breakthroughs are the exception in capitalism, not the rule. Also, the challenge is not only to address grand challenges, but actually to solve them. Otherwise the application of RRI would mean just identifying a few green and social products and processes. The latter can be regarded as useful but does not solve the challenges. So RRI needs to be modified, as discussed before, with regard to solving the grand challenges and be married with complementary, global approaches. Solving global challenges by using "research and innovation" would mean:

- Environmental economics has a toolbox for addressing ecological issues, comprising e.g. command and control regulations, tradeable permits, and taxes. Proponents of RRI should spell out why they place no hope in them or do not develop concepts for addressing global environmental issues by such means as part of their approach. For instance, carbon trading could limit emissions much like sulphur dioxide trading has (Burtraw 2000), but leaves it up to the consumers what type of car to use or when to burn carbon. To create demand for such a policy, it has been proposed that revenues from trading should be distributed among the global population (Weber 2013). The decision about what type of car to produce could then be left to the competing manufacturers and their consumers, instead of to some committee.
- Technology assessment has a toolbox for identifying potential problems. TA can lead, e.g., to proposals for global regulation, as in the cases of CFCs and carbon dioxide.
- A global change of values could be analysed and proposed. As long as the affluent parts of the world population continue to increase their consumption, there is no hope in reducing negative aspects such as emissions or road fatalities. This is a large topic which cannot be discussed here, but we mention it here to indicate that there are means other than RRI to solve the grand challenges.
- Also, is it conceivable that the world's product designers might collectively improve ecological or social features, similar to an engineer's code or social standards? What could be done to limit the force of competition from preventing this? This is yet another big field. Engineering ethics (including the ethics of product managers etc.) could address the consequences of secret components and processes, i.e. those which cannot be addressed in meetings with outsiders.

So combining value change with environmental economics and technology assessment could lead to – let us baptise it – "responsible production", a huge program.

References: Page 416

Navigating towards Responsible Research and Innovation

Challenges for Policy and Governance

Morten Velsing Nielsen, Ralf Lindner, Nina Bryndum, Ulla Burchardt, Monica Schofield and Jack Stilgoe

Abstract

The uptake and development of responsible research and innovation (RRI) ranges from policy debates to initiatives in the governance of research, technology and innovation. In this context, "responsibility" is interpreted with a twofold goal: a precautionary goal of avoiding an adverse impact on research and innovation and a promotional goal of supporting the desired impact of research and innovation. Some of the many inspirations for RRI governance can be found in, for example, foresight, technology assessment, responsibility frameworks, codes of conduct, and CSR. A growing number of studies question the effectiveness and legitimacy of these instruments as used in diverse settings. Thus, the conditions and the governance instruments currently used in RRI practice are underexposed and fairly unknown. Against this background, the session dealt with why we need RRI, which current practices can inspire RRI, and the challenges of making RRI a relevant concept from the perspectives of policy-making, industry and academia.

Introduction

Finding solutions to the question of how to implement responsible research and innovation (RRI) in policies at several levels of governance is a major challenge for the task of making RRI a relevant concept. What is clear is that such an implementation will demand a constructive collaboration between academia, policy makers and industry. The panel, invited by the Res-AGorA project,[1] met to discuss the experience in each of these fields, in particular:

1. The overall need for change at the policy level.
2. The potential practices of RRI.
3. The challenges facing RRI for it to become relevant across academia, policy making and industry.

As RRI is a relatively recent concept, debates are concerned with how core notions such as "desirability" and "responsibility" are to be understood both in relation to RRI governance itself and in relation to a given area of emerging technology and innovation. The panel debate showed a deeper concern about the ways in which the ideas of RRI could be taken up in academia, policy making and by businesses. While RRI intuitively seems like something positive, it is clear that constructive debate is needed for the concept to have a positive impact on research and innovation policy. The aim of the discussion was to contribute to resolving the current challenges to developing RRI, with a special focus on:

- Enhancing our analytical understanding of current policies for responsible research and innovation.
- Contributing to the analysis of the feasibility and desirability of different forms of governance practice for different domains and actors within research and innovation, such as business, ministries, research councils, research foundations, NGOs, and civil society.
- Discussing the development and usefulness of governance instruments that facilitate interaction and learning between these institutional and societal actors in a context of contestation.

These and related questions were discussed by our three invited speakers who brought an inspiring mix of different angles (public office and policy making, academia, industry) to the panel. The following will sum up key points from the panel presentations, present questions for further debate, and finally connect the discussion with the further work of the Res-AGorA project.

The Overall Need for Change at the Policy Level: Why Do We Need RRI?

While RRI is increasingly being discussed in both a European and a global context, it is not obvious why it has gained momentum during the last few years and what the reasoning is behind the current promotion of RRI. The call for responsibility is not new. The Club of Rome (1972) report on Limits to Growth was one of the first times local challenges were lifted up to a global level, and since then the necessity to deal with societal challenges has been debated; including the role of research and innovation in providing solutions. Particularly the Lund Declaration[2] of 2009 revived this debate in Europe. With RRI, this general thrust of increasingly orienting research and innovation towards addressing the so-called grand challenges was taken to the next level, now also emphasizing certain qualities of research and innovation practices and redefining the roles and responsibilities at the science-society interfaces. In the EU, RRI has been taken up as a core element of Horizon 2020,[3] with an emphasis on the need for RRI to cut across existing fields of research. In parallel to the actions taken by the European Commission, a number of activities and programmes run by industry, national governments, and public institutions show a similar interest in promoting responsibility. Initiatives such as the industry-driven Vision 2050

produced by the World Business Council for Sustainable Development (2010) show the commitment of companies to develop a long-term view focused on understanding both the technical and social challenges for a sustainable future. Still, there are signs that our approach to solving such grand challenges needs reconsidering. There is a tendency to focus strictly on technical solutions as well as on picking problems that seem relatively easy to solve. GDP is still a main measure of success, although it has been recognised to provide a very limited picture of the consequences of the actions taken. These approaches constrain the way complex challenges are dealt with, which in turn underscore the need for more comprehensive solutions. This point is increasingly being taken up by stakeholders. There is a need for the development of better governance processes that integrate all actors involved in innovation processes in order to address societal challenges.

The panellists view RRI as a concept with the potential to strengthen, broaden, and in many ways re-open the dialogue around the practices of research and innovation and its governance. While many basic questions about RRI still need to be addressed, there seems to be a growing interest in enhancing responsible practices of research and innovation among policy makers, academia and industry. A key issue is in what ways those who are developing the ideas of RRI can benefit and learn from existing governance practices.

The Potential Instruments of RRI: How Could We Practice RRI?

In developing practices of RRI it is important to look at both the successful and less successful practices of the past. In Germany, the goal of work on technology assessment has been to implement many of the ideals of what is now becoming known as RRI into German research and innovation institutions. This has helped to improve both the reflexivity on which technologies to develop and on the assessment of the potential desired and undesired consequences of emerging technology. The European Commission's (2009) recommendation on a code of conduct for responsible nanosciences and nanotechnologies research provides a good example of the difficulties in articulating the allocation of responsibility for unforeseen and unforeseeable consequences of research. While the attempt at embedding some form of accountability in the research community is perhaps increasingly seen as important from society's perspective, individual researchers can hardly be made accountable for all the consequences of their research that may occur in the future. The approach taken in formulating a code of conduct contrasts with the open, forward-looking, and more reflexive approach to RRI taken in frameworks such as the one developed by Stilgoe et al. (2013). An example of such a reflexive approach is given by the UK synthetic biology dialogues (BBSRC et al. 2010), which produced five questions for researchers to consider when developing new products:

1. What is the purpose?
2. What do you want to do with it?
3. What are you going to gain from it?

4. What else is it going to do?
5. How do you know you are right?

While RRI has yet to become an established practice, a key element will be to open up space for an informed debate on responsibility. Currently, there seems to be a lack of forums where stakeholders, including citizens, can debate and develop the ideas of responsible research and innovation. Such debate could assist RRI in learning from existing practices, but also in filling gaps where good practices are lacking.

The panellists highlight examples of existing work that should be considered in the development of RRI governance. Earlier experiences with technology assessment, codes of conduct and similar governance instruments can help inspire promising practices for RRI and point to key challenges to their implementation. The development of institutions for technology assessment has played an important role as an inspiration for RRI, yet there is a need for further documentation of good examples. Best practices from industry have so far been underrepresented in the debate on RRI and will have to be better included to expand the scope and context for RRI.

The Challenges to Implementing RRI: How Can RRI Be Made Relevant?

Despite broad agreement on the need for RRI, there are good reasons not to take RRI for granted as an important concept of European research and innovation policy. As the concept is currently being debated, it tends to be all encompassing, making it easy for any stakeholder to interpret it to fit their agenda. Yet if anything can be labelled as RRI, there will be no space for questioning and reflexivity. So while the integration of RRI within Horizon 2020 is a first step towards political significance, the substance of RRI needs to be developed more thoroughly before it can be taken up more broadly. For instance, many argue that the current operationalization of RRI within Horizon 2020 by the means of thematic headings such as gender, science communication or open access fails to grasp the concept's integrative and forward-looking qualities, and insufficiently opens-up debates about desired directions of research and innovation. A positive sign for the implementation of RRI is the focus on a better inclusion of societal concerns – a key objective of RRI. Examples such as the current debates on big data or novel types of innovation such as open innovation, social innovation, and frugal innovation show the potential of society playing an important role in both framing discussions and taking active part in innovation processes. Yet, questions remain regarding how RRI is related to current policies of growth and competitiveness, which are currently main drivers of EU research and innovation policy. Businesses are constantly evaluating whether Europe provides the optimal conditions for creating environments conducive to innovation and have earlier expressed concern about the use of the precautionary principle in Europe. This leaves the debate on RRI with a number of unresolved questions:

Is there tension between RRI and the principles of academic freedom, curiosity-driven/basic research? The word responsibility often spurs discussions on accountability and the ways to minimise risk, while the word innovation emphasises creativity and curiosity. Finding ways to meaningfully integrate such diverse objectives is a continuing challenge for RRI. As RRI becomes operationalised, there is a risk that creativity and experimentation will be downplayed.

Should RRI become a self-regulatory practice? RRI deals with issues that are notoriously difficult to legislate. Still, open self-regulating frameworks and other forms of soft regulation demand a strong commitment from stakeholders as well as drivers that make participation fruitful for all stakeholders.

How should social innovation be included in RRI? The solving of complex challenges will require technical solutions as well as new social processes. Merging ideas of social innovation with technology issues could provide an interesting way to address key challenges facing RRI.

These are question that should be addressed in the further work in the Res-AGorA project and other related RRI projects.

Developing a Framework for RRI Governance in the Res-AGorA Project

The panel debate that is the basis of this paper was organised by the Res-AGorA project. The objective of the project is to develop a governance framework for RRI and has two key starting points. First, the project does not consider RRI as something completely new, but as building on existing practice, e.g. work on technology assessment and codes of conduct, as already mentioned. The project therefore consists of extensive empirical work, which helps map the many existing practices that could contribute to a governance framework for RRI. Second, the project accepts that issues of research and innovation will remain contested. For this reason the project focuses on developing coherent governance processes which can take into account the variety of interests on a given issue. Through these processes stakeholders will systematically discuss RRI issues and find suitable solutions relevant to the respective context. Organisation of the panel at the PACITA conference marked the beginning of the final phase of the Res-AGorA project. In this so-called co-construction phase, stakeholders will debate and further develop the conclusions from the empirical program at five stakeholder workshops. The interactive workshops are not only a way to improve the results of the project, but are an experiment in creating structured spaces for an informed debate on RRI across institutional and disciplinary divides. They will therefore collect lessons from the participants' own experiences working with RRI and reflect on the usefulness of the space for dialogue on RRI created by the workshops.

Conclusions

RRI has the potential of becoming an important concept for European research and innovation policy, bringing together key stakeholders around a shared concern. This short paper has touched upon some of the reasons why such a concept has merits, but also several potential pitfalls that the concept needs to overcome. RRI brings to the fore the important objective of making research and innovation a driver for solving societal challenges. For this to materialise, it is important that RRI is not about blaming and defining individual accountability. Instead, for responsibility to be meaningful in the context of contemporary research and innovation processes, it needs to be increasingly understood as a forward-looking, shared responsibility. For RRI to be constructive, it should convince actors to keep reflecting and asking questions in the continuing search for better solutions. The day we become too comfortable with RRI, when it becomes a checklist, it loses its quality for innovation as well as responsibility. While the challenges to enhancing responsibility through the governance of research and innovation are substantial, the current debates on RRI show a willingness to engage with such challenges.

References: Page 416

Responsibility as Care for Research and Innovation

Sophie Pellé

Abstract

Among the various conceptions of responsibility that are used in the framework of responsible research and innovation, the paper defends a specific understanding of responsibility as care. First, the paper draws on Joan Tronto's conception of care ethics to highlight the correspondence with various dimensions of RRI that are the object of a growing literature on the subject. Second, following the work of Christopher Groves and Alexei Grinbaum, the paper investigates how the idea of care can help to conceive the issue of responsibility in research and innovation practices, through the ontological link it creates between a caring experience, our acts and our responsibility. Finally, it emphasizes possible limits to the attempt of applying care ethics to the context of research and innovation.

Introduction

The concept of responsible research and innovation (RRI) has gained much attention over the last decade as a new way of articulating science and society. It is sometimes defined with the help of five dimensions (Owen et al. 2012; Stilgoe et al., 2013; Owen et al. 2013; von Schomberg, 2013): responsibility in research and innovation (R&I) would emerge when information about RRI processes and their possible outcomes is available (transparency); when social values shape the development of R&I (participation and/or deliberation); when R&I processes adapt to a changing environment (responsiveness), when a collective reflection about potential outcomes is implemented (anticipation); and when social actors cast a critical look at their own way of assessing R&I outputs and processes (reflexivity).

Focused on the "ingredients" of RRI, such a conception raises many issues related to the implementation of R&I norms: how to put reflexivity into practice? How to ensure the quality and efficiency of deliberation and participation processes, and how to combine participation and deliberation (Pellé and Reber, forthcoming)? Furthermore, many conceptions of RRI do not investigate the various notions of responsibility, which have different meanings and applications in the context of RRI (Pellé and Reber, 2015).

This paper aims to investigate one of these meanings: the idea of responsibility as care. In line with the work of Groves (2009) and Grinbaum and Groves (2013), it shows that the concept of care helps to give substantive content to the notion of responsibility in RRI. First, the paper draws on Joan Tronto's conception of care ethics. Second, it highlights how understanding responsibility as care helps us conceive the various dimensions of RRI and to address key issues of this framework. Finally, it presents possible limits of such a conception.

Tronto's Fourfold Definition of Care

Among the various definitions of care ethics that have been developed since the seminal work of Carol Gilligan (1982), Joan Tronto (together with Berenice Fischer, in 1990) offers a broad definition according to which caring can be viewed as "a species activity that includes everything that we do to maintain, continue, and repair our 'world' so that we can live in it as well as possible" (Tronto, 2013, p. 19).

To clarify their understanding of care, Tronto and Fischer identify four steps in the process of care: caring about, caring for, care giving and care receiving, which correspond to the four elements of an ethics of care. First, a relationship based on care implies attentiveness by the caregiver, who becomes aware of others' needs. Inadequate attention and ignorance – i.e. when we (whether deliberately or not) fail to identify needs that should be taken care of – are moral evils. An ethics of care, in contrast, defends "a capacity genuinely to look for the perspective of the one in need." (Tronto, 2013, p. 34). The second ethical dimension of care is responsibility, understood as a willingness to respond and take care of needs. Someone (or some group of individuals) has to take the responsibility of meeting the needs that have been identified through attentiveness. Thirdly, when defending an ethics of care, the competence of the caregiver to provide good and successful care should count as a moral issue.[1] Interestingly, Tronto emphasises how judging the outcome of a care activity implies a consequentialist judgement. In her conception, if intentions matter, the result of a care process should also be assessed. Finally, the last ethical quality is responsiveness, i.e. the capacity to observe the answer of care receivers and to adapt accordingly (Tronto, 1993, 126-136).[2]

Care in Research and Innovation

Such a conception can be applied to the context of research and innovation and provides insights to understand responsibility in R&I processes. Indeed, Tronto's four elements of care ethics strongly echo the five dimensions of RRI mentioned in the introduction. In addition, the idea of care contributes to closely connect acts and our responsibilities to each other.

First, r***esponsiveness and responsibility are directly addressed***. Applied to RRI, responsiveness and attentiveness imply that innovators and researchers are aware of the

needs they help to create if technology destroys the environment or affects the health of a particular person or group of persons. It also requires that R&I social actors intend to respond adequately. This is one of the central contributions of care ethics: responsibility is conceived as intrinsically attached to a care-based relation. There is an ontological link between actions and responsibility, something that is crucial to enhance RRI.

Indeed, for many care ethicists, individuals should not be considered as fully autonomous (as liberal political and economic theories do) but rather as interrelated.[3] These "inter-relations" make us become care-receivers or care-givers. In the context of RRI, it would mean that scientists, innovators, and members of the civil society are not independent actors but, on the contrary, that they are bound together through the medium of their output (physical product, intellectual discovery, intervention in a public debate), which has (or will have) consequences on others. Scientists, innovators, decision makers, end-users or activists engage their responsibilities towards other members of society from the very moment they promote (or criticize) a new technology or a new research. And this responsibility covers not only the potential damages they could cause but also the danger of not developing a particular technology or developing it too slowly. In care ethics, the responsibility towards others, the environment, future generations or non-human beings stems from the relationships individuals inevitably create while participating in the social life.

Compared to Kantian-like theories based on abstract principles and duties, care ethics assume that our actions make us responsible of caring for others, the environment, ideas we defend, etc., in the best possible way. From this perspective, innovation and research activities create a responsibility for those who conduct the work to take care of the outputs as well as for other (human) beings, objects or ideas that might be affected by R&I processes. As Groves (2009, p. 13) has put it, "the experience of caring is the root of ethical behaviour – that is, acting in ways which value others in themselves." In other words, it is because we care about things (e.g. ideas, institutions, or books) that we are willing to take action to maintain, repair and defend them. The experience of caring leads to acts which are in turn inseparable from a certain form of responsibility.

Yet, this ontological responsibility is not only individual. Drawing on Hannah Arendt's conception of collective responsibility (which has to be distinguished from guilt), Grinbaum and Groves (2013) defend the idea that scientists are collegially responsible for what they directly contribute to production, but also in a broad sense for what they indirectly contribute to development.[4] Such an extended conception of responsibility is not necessarily related to individual or collective liability. It rather builds on a collective awareness of the ways in which science and technology transform our world and of the role each of us plays in this transformation.

Because it focuses on needs, care ethics also contains ***a form of anticipation***. According to Groves (2009), it is a future-oriented approach, which does not bear the rationalist overtone of traditional technology assessment activities (Grinbaum and Groves, 2013). Indeed, care ethics, inspired by Aristotle's Phronesis and Deweyan pragmatism, defends an approach in which norms are context dependant: the rightness or goodness of specific care-based relationships cannot be determined a priori by a principle or by a calculus, but only in relation to the context. In contrast to the universalist principles of many theories of justice, advocates of care ethics insist on developing a framework that offers both a moral foundation on which to make a normative judgement and a basis for taking concrete actions (Gilligan, 1982; Tronto 2013). If we come back to Tronto's definition of care, this would suggest that the actions that would have to be taken to maintain and repair our world and to determine what the "as well as possible" effectively implies still have to be defined. Yet, what a good caring experience includes is historically, culturally and socially situated and might have to be reconstructed when the context evolves. It might be worth pointing out that even if ***inclusion*** (participation and/or deliberation) is not explicitly mentioned by Tronto's definition, care ethics implies a collective and pluralist construction of our normative horizon. Indeed, care-based relationships stem from attentiveness and responsiveness, which do not allow for a top-down expert-driven and/ or a priori development of norms but rather favour a collective process of identifying needs and "good" caring practices in specific contexts. Moreover, caring about and for other (human) beings and the environment, for instance, might help to deal with the possibly conflicting voices of the members of society (who can in turn be care givers or care receivers).

Two Possible Limits

It appears that care ethics offers a promising basis for conceiving responsibility in R&I. However, further clarification is needed to adapt such a theory to RRI. First, care ethics might be seen as relativist since it does not provide clear principles to build on. This cannot be considered a serious critique because the focus on the interrelation between social actors (as opposed to the methodological individualism of rational choice theory, for instance), ensures moral pluralism and the co-construction of a collective normative horizon. In addition, this normative horizon is grounded on the attempt to "maintain, continue and repair our 'world' so that we can live in it as well as possible". This would give a broad but substantive framework for developing norms of actions.

Another possible limitation is that defining responsibility as care in RRI would inadequately gear concern toward the idea of need: care-based relationships grow out of the vulnerabilities of, for instance, children, patients, elderly people, the unemployed, and the disabled. They aim at meeting the needs created by these vulnerabilities. Grinbaum & Groves (2013) for instance, invoke a parent–child metaphor to analyse the relations between creators and their outputs. The author's focus on the vulnerability of others (and future generations) and claim that scientist and innovators have a responsibility to "'teach' or 'encode' the virtues" in created artifacts like parents try to do with their children. If some of the outcomes of science and technology can be represented in terms of created needs (e.g. when technology harms persons or groups of persons), they cannot be understood solely as potential needs. It could even seem paternalistic to affirm that scientists and innovators have to care about the needs

of consumers or civil society (even in the case of "social" innovation). In order to apply care ethics to RRI, we have to call up a flexible interpretation of the dyad care receivers/care givers where roles can be exchanged as when NGOs, end-users or the public at large care about scientists' and innovators' interests and motivations (von Schomberg, 2013).

Conclusion

In conclusion, understanding responsibility as care offers fruitful insights into RRI by giving substantive content to the notion of responsibility. First because it defines in a practical way dimensions of RRI such as responsiveness and anticipation. Second because it defends an ontological link between actions and responsibility that avoids being overly rationalistic. And finally because it provides a collective normative horizon directed towards the preservation and the flourishing of our world together with a concern for the institutional design that best helps to establish relations of care between the social actors of R&I.

Here I do not claim that every actor will always conceive of himself as being in a relation of care with others. This would probably be too idealistic. However, one interesting feature of care ethics (as defined by Tronto) is that it does not define a praxis based only on moral underpinnings. It also operates at the political level when it focuses on the institutional design that is needed to promote caring practices and collectively define a normative horizon (Tronto, 2013). The aim of political action is then to favour care relationships. For instance, scientists often draw on the division of labour between ethics and science to escape their own responsibility (Pellé and Nurock, 2011). Embracing a perspective in which individuals are interrelated and have responsibilities as soon as they act excludes such a division of labour. For RRI, this would imply focusing on a governance approach that would favour an attitude of shared care between, for example, investors, scientists, innovators, and end users through the design of institutional settings and the development of norms and laws. This would operate at an individual level – enhancing the virtue of social actors – but also at a systemic level – gearing cultural organizations, for instance through soft and hard law, training, education, and political discourse, to favour care-based relationships between the social actors in R&I (Hamington, 2011).

References: Page 416

Specific Challenges for Responsible Research and Innovation

RRI in Industrial Contexts and Human Brain Simulation

Bernd Carsten Stahl

Abstract

Discussions of responsible research and innovation (RRI) tend to focus on publicly funded research projects that take place in clearly described and predictable project settings. This is understandable as publicly funded activities should safeguard and promote the public interest. It can be problematic, however, if this leads to a neglect of research and innovation activities that take place outside of this clearly circumscribed field. This paper describes current RRI activities in two projects which go beyond it. It first outlines RRI in the Human Brain Project, which is a very large and multidisciplinary project where classical project governance structures may not be counted on to deliver RRI. The second project looks into the question of RRI in industry, where incentives and regulatory frameworks are different from those in publicly funded research. Drawing from these two sets of background, the paper asks how such non-standard research and innovation can be accommodated in RRI.

Introduction: Specific Challenges of Responsible Research and Innovation

Current discourses on responsible research and innovation (RRI) focus predominantly on publicly funded research and innovation activities. It is easy to see that such research relies on public support for continued funding and there is an easy case to be made that it has to be legitimate and be socially acceptable and desirable (von Schomberg 2013). This case rests on the public nature of the funds used to support the research. Very briefly, one can argue that, if the taxpayer pays for the research, then the taxpayer should benefit from it. This has of course always been an implicit assumption of public research funding, but in the past the benefit for the public was more generally defined as the provision of innovation and the training of scientists, which was the output of the science system that would satisfy the public interest (Jasanoff 2011). In recent decades the general support for science has been affected by high profile cases of questionable scientific conduct and by public debates concerning the consequences of research, such as nuclear power production or genetically modified organisms. RRI can be read as an attempt to take these concerns seriously and ensuring that publicly funded research lives up to its promises.

Much of the discourse on RRI understandably focuses on the type of research that has been undertaken under the auspices of the public funder within the governance arrangements that characterise such publicly funded research. This is perfectly acceptable, but it is also a limited view. If RRI is to be practically relevant and have an impact on real research and innovation activities, then it needs to be applicable to all research that is capable of affecting the public interest. This means that it will have to cover research funded from other sources, notably industry funded research and innovation that aims to develop new products and services with a view to increasing company profits. RRI will also need to find ways of being relevant where project management and governance structures are less clear and under constant negotiation.

This paper explores some of the issues that arise in such environments, where the sources of funding are private or where the project governance structure is complex. The paper briefly outlines two currently ongoing projects, one which focuses on the role of RRI in industry, the other one is a highly complex and large project in the field of human brain simulation. It will recount some of the preliminary empirical findings of these two projects and discuss the implications they have for the debate on RRI.

Human Brain Simulation

The first project presented is the EU Flagship Human Brain Project (HBP, https://www.humanbrainproject.eu/). The HBP is a European Commission Future and Emerging Technologies Flagship that aims to accelerate our understanding of the human brain, enable advances in defining and diagnosing brain disorders, and develop new brain-like technologies. As one of the two European flagship projects, the HBP is the recipient of funding worth several hundred million euros and has a duration of more than 10 years. It is a highly interdisciplinary project bringing together scholars from neuroscience, computer science, medicine, social science, philosophy and other fields.

The project was designed with the principles of RRI in mind. As a consequence it contains a subproject on ethical and social issues. This subproject is based on the principles of RRI as developed by Stilgoe et al. (2013) and adopted by the UK Engineering and Physical Science Research Council (EPSRC).[1] The EPSRC uses the AREA acronym to refer to RRI which stands for anticipate, reflect, engage and act. The society and ethics subproject of the HBP aims to address all of these aspects. It contains a full work package dedicated to foresight activities (anticipate), a work package focusing on engagement, one work package on philosophical and conceptual work and one dedicated to the exploration of views within the project (reflect). Finally, there is a work package on governance which includes a research ethics committee and an ethical legal and social aspects committee which are meant to direct the activities within the project as a whole (act).

This structure reflecting the principles of RRI was implemented because it was visible from the outset that the project had the potential to raise significant ethical and societal concerns. Ethical issues arising from the project have been highlighted and discussed by authors both from outside the project (Lim 2013) and members of the society and ethics section of the project itself (Rose 2014).

The component of the project that informs the present paper is one of the work packages of the society and ethics subproject called researcher awareness. The purpose of the work package is to stimulate debate within the HBP in order to harness the experience and expert knowledge of its members to raise awareness of ethical issues. The first step of this activity consisted of a set of interviews with the leaders of all 13 subprojects. The idea was to highlight those ethical concerns that the leading scientists of the project are aware of and discuss how they are or should be addressed. In addition the interviews were meant to show whether there were gaps in current awareness.

This paper does not provide space for a more detailed discussion of the findings. Suffice it to say that the interviews confirmed that there are a significant number of potential ethical concerns. Ethical themes were defined as those issues that raised questions about the moral, legal or professional status, duties or roles of stakeholders in the HBP and respondents raised the following:

- Data protection and individual privacy
- Governance of data provided to the open-access platforms
- The appropriate use of animal experimentation and development of common standards
- Research integrity including the maintenance of scientific diversity through collaboration
- Intellectual property
- The appropriate use of medical and robotic applications

Respondents touched upon all aspects of responsible research and innovation listed by the European Union's Horizon 2020 programme. Extrapolating into an uncertain future was problematic for many but recognised as necessary. Reflection, in the guise of maintaining scientific integrity and engagement with stakeholders, were the two most common interpretations of RRI.

It is important to see that the issues contained in the above list are those that are not open to simple solutions. The HBP also raises a number of more traditional research ethics questions, such as human data collection or animal experiments. These are covered in their research governance work package and lead to significant bureaucratic efforts, but appear to be generally viewed as resolved.

From the perspective of this paper it is interesting that the dominant issues are not fundamentally surprising and have mostly been foreseen during the development of the proposal. They nevertheless remain unresolved. Despite much collaboration between the society and ethics group and the scientific and technical subprojects, the intrinsic complexity of the problems (e.g. data protection of medical data in a highly distributed system) is such that they are not easily overcome. In addition the organisational complexity of the project can make it difficult to assign responsibilities for a particular issue or its resolution.

RRI in Industry

The second project to be briefly discussed here is called "Responsible-Industry" (www. responsible-industry.eu). This project focuses on the question of why and how RRI could play a role in research and innovation activities that are privately funded. The profit motive of private research funding is not necessarily consistent with a focus on societal acceptability and desirability. The question thus is why industry might want to engage with RRI in the first place and which forms such engagement could take. For methodological reasons the project focuses on one particular technology, namely ICT, and on one specific grand challenge to be addressed through this technology, namely the challenge of health, demographic change and well-being.

The idea of the project is to undertake a number of initial fact-finding activities to determine how responsibility is interpreted and viewed by industry and other stakeholders involved in industry funded research. These activities include 30 in-depth interviews with industry experts, a Delphi study with more than 150 experts as well as a set of five bottom-up case studies of good practice of RRI in industry. On the basis of these empirical investigations as well as a detailed literature review, the project develops an implementation plan for RRI in industry. This implementation plan is then to be tested in four case studies in industry as well as 15 industry focused focus groups.

Domains	Response
Individual rights and liberties (privacy, rights to freedom of movement, etc.)	49%
Health	48%
Autonomy, authenticity and identity (free will, ability to have one's own thoughts and make one's own decisions, to develop social identity)	41%
Social isolation	28%
Personal safety	26%
Integrity and dignity	26%
Justice, access and equality	23%
Bodily integrity (self-determination of human beings over their own bodies)	22%
Social safety	10%
Dual use of developed technologies	10%
Environment	3%

Table 2: Domains most susceptible to ethical and societal risks in the design and development of ICT products for an ageing society

At the time of writing the initial investigations had been concluded and the project was in the process of developing and refining the implementation plan. Again this paper does not provide space to discuss any of these in detail and can only highlight a few interesting findings. The first one of these is probably that the term RRI is not widely known in industry. This is not particularly surprising, given that it is a concept that comes from research. However, it quickly became clear that many of the aspects that RRI aims to promote, such as foresight, public engagement or ethics reflection, are widely used and implemented in the ICT for ageing and well-being industry.

The Delphi study (Borsella et al. 2015) did show some interesting results. One of these was that the respondents are clearly aware that research and innovation activities in ICT for ageing and well-being can raise significant concerns and require a heightened level of responsibility. The table 2 shows some of the key areas of concern.

It is thus clear that the respondents to the Delphi understand the importance of RRI. One surprising insight arising from the Delphi was that the motivations for addressing broader concerns in industry are not as narrow and focused on functional benefits as one might expect. While commercial organisations are by definition profit oriented, the respondents indicated that the reasons for engaging in RRI are much broader than those that refer directly to profit generation. The following figure represents the answers to the question why respondents would engage in RRI as received in the first round of the Delphi study:

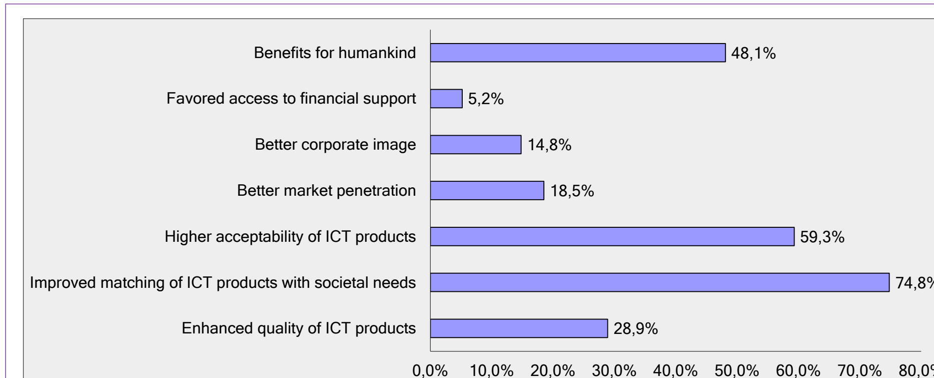


Figure 1: Possible benefits from the inclusion of RRI in the ICT industry for an ageing society

Overall the preliminary findings of the project at this stage seem to suggest that a possible preconception that companies are less interested in RRI and, if they are interested, pursue it only for functional reasons would be wrong. Companies display a complex mix of motivations. In practice they can be much more advanced in terms of responsible research and innovation than publicly funded research organisations.

The way in which the concept of RRI can be communicated to profit oriented organisations therefore requires further thought. A suitable way maybe to identify good practice and to use insight gained about possible ways of implementing RRI in industry to supplement existing strengths. A further question would be how RRI could be integrated in existing structures and processes including, for example, corporate social responsibility, quality assurance and of course research and development.

Conclusion

This paper gives a brief update of RRI-related research in two research projects. These projects are characterised by the fact that they focus on environments that diverged from those usually implied in the discourse on RRI. In one case the project is highly complex, multidisciplinary and requires very specific governance structures due to its size and subject matters. In the other case the question of the role of RRI in privately funded research and innovation activities was explored.

The brief overview outlined here does not allow for any robust conclusions or recommendations. But it does provide some interesting insights. It shows that RRI has relevance beyond standard academic research projects, but that the way it is realised and implemented is not always straightforward. As always, the devil is in the detail. The human brain project, despite its strong emphasis on RRI, is still struggling with the question of how to make sure that responsibilities get distributed across the consortium and RRI is not seen as a specialist activity by the experts in the society and ethics sub-project. Such questions of implementation appear to be of similar relevance in the industry context. Industry and profit oriented companies are engaged in numerous responsibilities. The question how the RRI discourse relates to these existing responsibilities is currently far from clear. Further work both in the HBP and Responsible-Industry will shed further light on these questions.

One tentative conclusion to be drawn from these observations is that the discourse on RRI needs to explicitly conceptualise questions of implementation and evaluation of RRI activities. Elsewhere I have suggested seeing RRI as a meta-responsibility, which aims to shape, maintain, develop, coordinate and align existing and novel responsibilities (Stahl 2013). To put it differently, we do not need to invent new responsibilities but make sure that the existing ones work in a way that leads to an overall desirable outcome. The observations discussed in this paper support that position. Aligning and shaping existing responsibilities to achieve a societal goal will require more than principles and examples of good practice. It will need active leadership by individuals with a vision. It will entail power struggles and tactical manoeuvres. It will on occasion be messy and confusing as social realities usually are. RRI, if it is to move beyond window dressing, will need to accept this challenge.

References: Page 417

Governance of Nanomaterials as Laboratory for RRI

Jutta Jahnel

Abstract

This contribution focuses on the development of advanced risk governance models which overcome the institutionalized separation of risk assessment and risk management. New frameworks for governing chemicals, technologies and products take into account that scientific, social and ethical aspects are closely interwoven in modern societies. This implies an improved design for interactions between scientists and politicians moving from linear to more responsive network approaches. Additional framing or scoping steps engaging a broad range of stakeholders should enhance scientific risk assessment. Questions arise how these advancements are related to the emerging and abstract steering model of Responsible Research and Innovation (RRI) with its general dimension of responsiveness and inclusiveness. Especially risk governance of nanomaterials could serve as an initial field for studying RRI in practice. Substantial and procedural problems in the traditional assessment procedure as well as the question about adequate risk management options lead to a responsible code of conduct and new participatory processes in the early stage of innovation. From the outcome of these experiments we can gain useful insights for the understanding and implementation of organized ‘co-responsibility’ in other contexts.

Responsible Research and Innovation: Emergence and Motivations

Responsible Research and Innovation (RRI) is a vague umbrella term for a new attention on ethical questions around the governance of new and emerging technologies. Although there is no consensus on the detailed understanding or the transformation of this abstract and open vision into practice, it has wide ranging impacts on the interplay of science, technology and society. One manifested example is that RRI is used as a key word in research and innovation policies framing numerous scientific agendas and communities, e.g. the Regulation EU 1291 (2013) establishing Horizon 2020. This influence on science policy is surely based on new impulses for interactions of key actors in innovation processes that should be steered for the development of socially robust products and technologies. According to the working definition in the European context, RRI is a “transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products" (von Schomberg 2013). Several authors proposed comprehensible quality criteria for describing and identifying the tacit and abstract framing program (e.g. Stilgoe et al. 2013, Wickson/Carew 2014). Also a range of projects are dealing with a common understanding or even the implementation of RRI.[1] But many fundamental questions so far remain open. Should RRI be understood as a long-term and continuously evolved spirit and a new culture of responsibility and networking? On the other hand RRI could also be interpreted as a concise paradigm shift in research and innovation. For addressing this question it is useful to look at the normative as well as the epistemic motivations for the implementation of the issue of responsibility. First of all, actors want to achieve binding outcomes in decision making or enhance the safety and quality of innovation products. This motivation is predominantly based on substantive criteria and the anticipatory dimension of RRI. Secondly, RRI addresses process-based norms such as inclusiveness, responsiveness, transparency and openness enhancing social and procedural aspects of innovation processes. Finally, RRI will be implemented instrumentally to secure particular better ends such as economic growth, trust or acceptance (Regulation EU 1291 2013).

Overall, RRI is a kind of research and innovation governance which distributes responsibility across the traditional walls between scientists, politicians and citizens. In general, governance includes processes, conventions and institutions that determine how power is exercised in managing resources and interests, how important decisions are made, how conflicts are resolved and how interactions among and between the key actors in the field are organized and structured (Lyall/Tait 2005). This contribution tries to elucidate the close relation between RRI and different governance models. Especially the developments in the risk governance of nanomaterials will give useful indications of the way to a better understanding of RRI.

The Science and Decision Interplay in Risk Governance Frameworks

Risk assessment is a prerequisite for science-based risk management and means the quantification of the probability of harmful effects (NRC 1983). It is an important element in risk analysis of new and emerging technologies. From a social science perspective the expert-delegated risk assessment procedure was supported by society due to the power of evidence of this intrinsically scientific procedure. Besides this results-based legitimacy the well-established and institutionalized practice of risk assessment also contributed to a procedural legitimacy. This twofold legitimacy is part of the 'social contract of science' which presumes the integrity of scientists as neutral, independent, unbiased and objective risk assessors and the institutional and conceptual separation between politics and science (Guston 2000). Institutionalized scientific risk assessment and political deliberation take place in separate compartments with a unidirectional information flow and a more or less artificial separation of scientific and normative aspects (NRC 1983).

However, in modern societies a disappearance of boundaries between the protected area of an organized science laboratory and the complex social environment is observable. Especially the high degree of scientific uncertainty and ambiguity in assessing new technologies leads to dominant substantive and also procedural limitations in conventional evidence-based risk analysis. In addition, the communication between risk assessors and risk managers is increasingly challenged by a lack of common and adequate terminology and interaction. Risk assessment evolved into a highly complex, incomprehensible and ambiguous process where scientists determine means as well as dominant ends which could not be translated into adequate risk management decisions by politicians (SCHER, SCENIHR, SCCS 2013). This is the reason why outsiders of risk analysis perceive an erosion of trustworthiness and transparency in decision making.

Since the publication of the 'Red Book' (NRC 1983) with its fundamental principles for chemical risk assessment, an ongoing improvement and a further continuous development of traditional risk analysis could be observed during the following decades. In 2009 an advanced risk governance model, the so-called 'Silver Book', was presented which introduced a new process design for the relation and interaction of science and decisions (NRC 2009). Today the expert assessment of chemicals is sandwiched between an additional up-stream framing and problem formulation step and the traditional down-stream risk management step with a bi-directional information flow. Up-stream risk management comprises framing assumptions with substantive, procedural or interpretative aspects for risk assessment. This framing step could be performed inclusively by different stakeholders from different perspectives. The Silver Book model is a kind of re-design of the conventional science and decision relation where political decisions followed scientific deliberations in the separated risk assessment procedure. Parallel developments for risk governance could be found in other risk contexts besides the health risk appraisal of chemicals. Examples are the circularly designed risk governance framework for technologies (IRGC 2006) and the general framework for the precautionary and inclusive governance of food safety (Dreyer/Renn 2009). In table 3 the differences from the traditional Red Book model for chemicals are presented.

	Red Book	Silver Book	IRGC Model	Food Safety Governance
Publisher (year of publication)	NRC (1983)	NRC (2009)	IRGC (2006)	Dreyer and Renn (2009)
Narrative	Evidence-based decision making	Risk-based decision making	Science in policy making	Precautionary and inclusive governance
Application	Conventional chemicals	New chemicals	Technologies	Products (food)
Science and decision steps	Risk assessment Risk management	Problem formulation and scoping Risk assessment Risk management	Pre-assessment Risk appraisal Tolerability and acceptability judgement Risk management	Framing Assessment Evaluation Risk management
Process design	Linear, unidirectional	Co-dynamic linear, bidirectional, adaptive	Open, cyclical, iterative, interlinked, co-evolutionary	Cyclical, iterative, adaptive, inclusive, precautionary

Table 3: Comparison of different risk governance models

Common to all presented advanced governance models is the additional framing, scoping or pre-assessment step which is separated from the main expert assessment as a socially variable judgement step. This also implies an integration of a broader range of stakeholders at the knowledge-creation phase and thus an opening-up of the scientific risk assessment. The frameworks are examples for the transformation of the principles of inclusion, openness, transparency and responsibility into practice according to the normative goals of good governance. The information flow between scientists and politicians changed in all models from a linear and rigid direction to a cyclical, iterative, adaptive and responsive network approach with an improved interaction between the two mutually influenced compartments of science and decisions. The delegation of politics and science has changed into a 'collaborative assurance' that marks the end of the traditional 'social contract for science' (Guston 2000).

From Risk Governance to Responsible Research and Innovation

While Table 3 gives an overview for different governance models in limited application fields such as chemicals, technologies or products, RRI is important for the entire innovation process. The question arises whether RRI is evolving from a continuous trend of organizing responsibility in different governance models or whether it is rather a discontinuous break and a paradigm shift for innovation processes.

The presented developments in risk governance give some useful indications with regard to this question. The narratives of the different models changed from 'evidence-based decision making' to 'risk-based decision making' and resulted in 'precautionary and inclusive governance' (Table 3). This characterizes a further development from an evidence-based rationale to a process-based decision making. RRI continues this process with its narrative *'science **with** … society'*. But it also introduces a new orientation for innovations which is expressed in the narrative *'science with and **for** society'* (Regulation EU 1291, 2013). This new dimension of RRI could be interpreted as a paradigm shift for innovation processes. In contrast to the open, cyclical and inclusive process designs of the presented governance examples in Table 3, the overarching social interaction model of RRI is a general non-linear network approach. Consequently, RRI is not only a simple continuation of process-designs for single applications, but rather an overarching higher abstraction level for a range of developed governance cases.

This leads to another important question: Is risk governance of nanomaterials a "test case for a new sort of governance" (Tallacchini 2009) or rather a root of RRI? The "responsible turn" of risk governance of nanomaterials obviously pointed to a concrete test case of the abstract steering concept of RRI (Grunwald 2014). However, the principles of the Code of Conduct for Responsible Nanoscience and Nanotechnologies with its general normative principles of responsibility, sustainability, precaution and well-being could also be seen as a precursor of RRI (EC 2008). This argument is supported by the proposal of the European Commission to widen the nano-specific Code of Conduct for all new and emerging technologies. The

core term should be 'responsibility' "understood as the mutual responsiveness of all actors involved" (EC 2011, p. 2). It seems not the right question to ask what came first, RRI or the developed measures for the responsible handling of nanomaterials with its deliberative processes, upstream engagement and upstream product design. Both concepts are closely interwoven and parts of different abstraction levels without a necessary succession or chronological order. More important is the fact that risk governance could be used as a 'laboratory' for the principles of RRI. From the experiences in the context of nanotechnology we will learn a lot about the benefits, but also about the lack of adequate methods and the limits of "mutual responsiveness". Conflicts and ambiguity could be unresolved obstacles in decision making and should also be considered in debates about RRI (Jahnel/Fleischer in press 2015).

Conclusion

Based on the substantive and procedural limitations of the linearly designed interaction between scientists and politicians, new models of connectivity and interaction were developed in risk governance of materials, technologies and products. These approaches should help to update society's support for science and science's reciprocal responsibility to modern society where the boundary between normativity and evidence could not be confirmed any longer. In this situation the concept of RRI paved the way for a new science and innovation policy based on 'co-responsibility' of formerly separated stakeholders and parties. This higher level of collaboration, inclusiveness and responsiveness should result in better analyses of health and environmental risks for new and emerging technologies. But it could only take place where institutionalized routines were questioned and responsibility is organized across traditional boundaries between science, politics and society. And it could only deploy its positive impact on future innovations if the limitations of inclusiveness are also seriously addressed.

References: Page 418

On the Convergence of TA with Ethics in RRI

Challenges to Public Engagement

Rasmus Øjvind Nielsen, Lise Bitsch and Morten Velsing Nielsen

Abstract

RRI can at present perhaps best be described as a 'work in progress'. It is a patchwork of different practices for assessing research and innovation, with each practice trying to carve out its own space under the RRI discourse. In this brief commentary, we will discuss three challenges to the 'public engagement' dimension of RRI. These challenges crystalize around the three interrelated questions of institutional mandates, capacity building, and practices.

Introduction

A key innovative feature of recent calls for responsible research and innovation (RRI), issued by the EC and by academic stakeholders, is the attempt to shift the emphasis from individual to collective responsibility for innovation processes. In these calls, the starting point for RRI is the ambition to, in an inclusive and democratic way, ask and answer the question of 'what sort of future we collectively want innovation to create for Europe?' (Owen et al., 2012; Owen et al., 2013; Stilgoe et al., 2013; von Schomberg 2013). Among other features, the active involvement of stakeholders in research and innovation (like governmental bodies, research institutions, corporations, NGO's and civil society organisations and to some extent 'the public') and their reflection on their work are described as safeguarding the democratic element of the process.

From an academic perspective, RRI can broadly be seen as an outcome of research in applied ethics, technology assessment (TA), the public understanding of science (PUS), and science and technology studies (STS) (e.g. Grunwald 2011; Stilgoe et al., 2013). Each of these areas of research has its own approaches and traditions, but all are also broadly concerned with understanding and improving R&I processes and their outcomes. At present, academics most often refer to the framework and four dimensions described by Stilgoe et al. (2013) as anticipation, reflexivity, inclusion and responsiveness.

From a policy perspective, the roots of RRI are in the construction of the European Research Area (ERA) and the subsequent framework programs of the European Commission for funding research. Within each framework program, there has been a specific focus on the science–society relationship. The conceptualisation of this relationship has developed over the years to have a strong focus on two-way dialogue, public engagement, science education and outreach. Subsequently the research program has gone from being called 'science and society' to 'science with and for society'. At the policy level, RRI is defined by six key dimensions: open access, science education, governance, ethics, gender and public engagement (EU Commission n.d.). Each key dimension is central to the development of RRI from the point of view of the EU commission.

RRI can at present perhaps best be described as a 'work in progress'. It is a patchwork of different practices to assessment of research and innovation, with each practice trying to carve out its own space under the RRI discourse. In this brief commentary, we will discuss the 'public engagement' dimension of RRI. We make these comments with the hope that the lessons learned from engagement exercises in TA institutional settings over the last 25 years will be inspirational for the development of engagement practices under RRI.

The Challenge Posed by Public Participation in Research and Innovation

The convergence of traditions which RRI embodies is not only a matter of intellectual development or the integration of different principles. It is equally, and equally importantly, a matter of institutional spheres of authority, capacity and practices becoming interlinked in a common framework for public administration and governance. The emergence of this framework is based on an overarching vision of a more responsive system of European innovation, and the process of emergence is driven by the actions of centrally placed institutional entrepreneurs . The basic strategy being pursued is to move 'soft' approaches to innovation governance such as technology assessment and ethics out of their fringe position in the science in society program in order to affect the 'hard science' research programs more directly. There is an obvious appeal to this strategy; nothing is more frustrating than seeing progressive research and policy become confined in their separate habitats while the mainstream charges ahead along the lines of business as usual. But any attempt at involving citizens in participatory exercises with the aim of achieving a broader impact on the pathways of innovation must be aware of the risk of tokenism (Arnstein 1969).

Institutional TA practitioners have always had to work around the tendency of public participation to degenerate into placation, opinion therapy and manipulation. These effects are dangers of politics, policy, and public administration (and administrators), and their reflex to retain and reclaim control of (and power over) the policy-making process. The present convergence of research traditions and EU policy agendas in a common administration framework is an obvious occasion for such degeneration to take place under the cover of increased participation to achieve more responsible research and innovation processes and outcomes.

Public Engagement in EU RRI Projects

A recent, interesting and concrete example of the convergence of ethics and technology assessment may be observed in the EU project SATORI (Stakeholders Acting Together on the ethical impact assessment of Research and Innovation). The SATORI project aims to produce a common European framework of ethical assessment of research and innovation (satoriproject.eu).[1]

The SATORI consortium represents a mix of backgrounds and research competence. Represented are for example researchers of the philosophy of technology, governance of research ethics, standardization, international science governance, science communication and (parliamentary) technology assessment (TA). In finding a common ground, the group works with the approach presented in Figure 2. The figure nicely illustrates the convergence of ethics with different assessment traditions. In the figure, technology assessment has been grouped under the broad category of impact assessment.

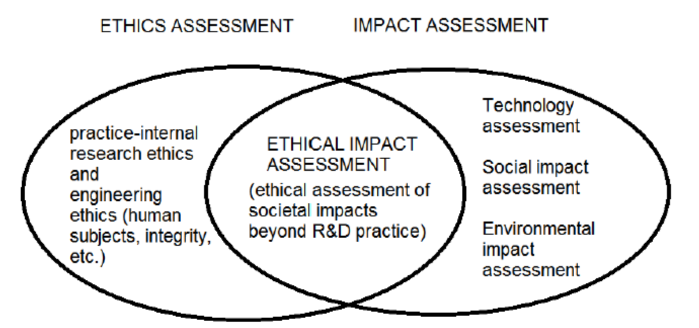


Figure 2: Three types of assessment

As this convergence is driven by ongoing developments in the institutional environment, the process of convergence poses a challenge to the participants who - representing very different traditions – do not necessarily perceive a pressing need for such convergence from the point of view of their professions.

Challenges to Convergence:
Between the State of the Art and the Lowest Common Denominator

The administrative aggregation of traditions can go one of two ways, either towards spreading state-of-the-art practices or towards convergence on the lowest common denominator. In the following, we pose and discuss three challenges to steering the process towards spreading state-of-the-art practices. These challenges crystalize around the three interrelated questions of institutional mandates, capacity building, and practices.

Challenge 1: Embedding mandates for public engagement in democratic accountability structures

Institutional mandates for intervening in science, technology and innovation (STI) are very different from country to country and between levels of governance. Even within the relatively small group of partners in the SATORI project, ethics and technology assessment interact with technological innovation and governance in a wide variety of ways. Discussions in the group have revealed that platforms for the ethical assessment of STI range from quasi-regulatory agencies in Germany and Austria, through governmental advisory bodies in the Scandinavian countries, to reflexive practices internal to science or innovation stemming from the Dutch and British traditions. Similarly, technology assessment actors had different degrees of mandated influence over decision-making in parliaments and governments in different countries. In some countries TA practices are embedded in government, while in others they are embedded in industry and academia rather than government. These differences are important to remember.

'Network governance' is currently all the rage in European policy circles, and it is very easy to slip into a situation where RRI and its public engagement dimension are framed in such terms. However, while the often cited argument of increased efficacy through networking may be well founded, case after case have also shown an increased risk that such governance forms loose accountability and become subject to manipulation by powerful industry interests. It might be wise to remember that past institutional TA actors worked for more responsible forms of scientific and technological innovation, and showed success with embedding mandates by establishing such responsibility within democratic institutions. While the process of promoting such embedding is without a doubt more difficult than similar processes leading to loosely structured networks, democratically embedded mandates are on the other hand more likely to achieve formal influence over policy and to include mechanisms of public accountability.

In any case, it is necessary that facilitators of public engagement should have the mandate necessary to strike a balance between understeering (where powerful actors may overtake the process) and oversteering (where the facilitation is structured towards producing a certain result). Their mandates, in other words, must extend beyond what is normally understood as facilitation to what has been termed microlevel meta-governance (e.g. Sørensen 2013). Such mandates may help to drive public participation up the steps of Arnstein's ladder towards higher degrees of citizen influence.

Challenge 2: Supporting and developing capacities for participation through ongoing learning and practice

One does not just 'do' public engagement. Capacity building should therefore be an essential aspect of RRI. Here it is interesting to observe differences between countries and academic and professional organisations. In Denmark, the Netherlands, and Norway, the technology assessment institutions have built their capacity for public engagement as a natural part

of their core institutional priorities. Other institutions, such as the German Institute for Technology Assessment and Systems Analysis (ITAS), have gradually reinterpreted their institutional mission in order for such capacity building to gain legitimacy. Many institutions and agencies, however, where members of staff see the logic of public participation, struggle to effect such reinterpretations of missions and mandates. They therefore lack the backing necessary to build up experience and capacity in performing public engagement. The same difference can be observed in the academic world, where some research groups manage to set up platforms, while others struggle to pursue citizen participation within university structures that incentivize peer-reviewed publication over societal interaction. An example of the former is the Sussex University STEPS Centre, where public engagement is written into their DNA.

The lowest common denominator to be avoided is the reproduction and generalization of the situation in which public engagement becomes a point of view among a range of ideal ambitions, while an incentive structure promotes the priority of other 'core' activities, be they the delivery of evidence-based advice or peer-reviewed publications. Public engagement is an art that requires ongoing focus and learning, not something to be added on as an afterthought to projects pursuing entirely different goals. No one method can provide 'participation' in any and all situations. Useful and accessible methodologies exist to help practitioners select the right tool for the job (e.g. Decker and Ladikas 2004, Ely and Oxley 2014), but they need to be practiced. For this reason, demands for increased public participation in science and the governance of innovation must be accompanied by measures to develop the capacities appropriate for the task.

This point is crucial, as there is a real danger connected with assuming that the 'right' methods can solve the issue of making public engagement work within RRI. Along with the mainstreaming of public engagement, it is inevitable that simplified how to-manuals will emerge to help researchers and innovators to get on with it; this is a perfectly natural need, and providing the manuals is a perfectly respectable type of service. The danger, however, is that attempts at implementing participation methodology that do not take into account the institutional and organizational prerequisites for applying the methods will lead to participation fatigue spreading even faster than the actual practice. Who, during coffee breaks of European consortium meetings, has not discussed the politically incorrect, but nevertheless heartfelt view that 'participation never really works'? This notion spreads naturally from participation 'exercises' that go through the motions of participation methodology without first laying the ground in terms of institutional openness and organizational capacity. Citizens, wary of being held hostage to merely symbolic processes, sniff out fake participation with uncanny speed and precision and leave project managers and administrators feeling disparaged. For this reason, any pedagogy of participation should first and foremost discuss the institutional setting and organizational capacities needed to make it work.

With this in mind, we turn at last to a third challenge having to do with concrete practices that will have to merge as ethical assessment and TA converge.

Challenge 3: Combining participation with comprehensive evidence-based analysis and principled reflection

Within the space of this text, it is impossible to do justice to the richness of difference, overlaps and mutual inspirations that have characterized the emergence of the ethics of technology and technology assessment. The fields of ethics that somehow touch upon science, technology and innovation are rich and varied. Similarly, technology assessment has had several different strands of development evolving around different methodological approaches. Nevertheless, one specific set of characteristics is typically seen as cutting across the two traditions.

It is true of both ethical assessment and technology assessment that their starting point for methodological development has been expert analysis carried out by relatively small groups of analysts with specialized sets of skill. This basic approach has remained a backbone element of both traditions, but both traditions have also branched into at least two other types of approaches that emphasize public participation and stakeholder reflection respectively. With the two traditions converging, the question is: how do we combine the strengths of these approaches. We would suggest the following approach.

Expert technology assessment has the advantage of gathering comprehensive evidence concerning any possible impact, but suffers from the risk of being framed by industry. Ethical assessment suffers from a risk of remaining at the surface of concrete technological possibilities, but has the power of relying on foundational principles, such as human rights, to challenge directly the issue framings produced by government and industry. Participatory technology assessment has the strength of access to decision-makers and of methods aiming at bridging public sentiment and decision-making processes, whereas ethical assessment, in as far as it makes use of participation, tends to use it to inform the core expert group who act in effect as gatekeepers between decision-makers and the public. The majority of reflexive technology assessment approaches have a co-constructive approach to reflexivity. Such an approach creates the risk of assessors being captured by the processes they aim to assess. A common framing intended to articulate the converging of traditions in a common framework should therefore – following this simplified schematic – aim to include the traditional elements of comprehensive fact finding (from TA), principled analysis (from ethics), and the application of methods for direct citizen participation (from TA), supplemented by reflexive methodologies with methods for principled reflection in individual and group settings (from ethics).

References: Page 419

Responsible Innovation as a Critique of Technology Assessment

Harro van Lente, Tsjalling Swierstra and Pierre-Benoit Joly

Abstract

The notion of 'responsible innovation' has become fashionable amongst policy makers and knowledge institutes. In the new Horizon 2020 calls of the European Union, 'responsible research and innovation' (RRI) figures prominently as a condition and an aim in itself. The rise of RRI shows considerable overlap with the aims, philosophies, and practices of Technology Assessment (TA). The overlap, though, is not perfect and this raises questions about how RRI relates to TA. While it is plausible to interpret the relationship as RRI being a sequel of TA ambitions, we explore an alternative interpretation: RRI as a critique of TA.

Histories of TA and RRI

Technology Assessment (TA) has a history of about five decades. It is a set of practices and approaches which have evolved over time. The initial attempts, exemplified by the activities of the Office of Technology Assessment, were to make statements about the future performance of technologies in order to assess their impact on society. The term 'impact' refers to the metaphor of an external object that unsettles a more or less stable substrate. The idea was that it was possible and useful to map the consequences of the future technology on all kinds of relevant dimensions, such as employment, industrial structure, health, or economic competition. Basically, it contained a cost-benefit approach, supported by probabilistic methods such as risk calculations and decision theory. The approach also assumed that experts (and experts only) could make assessments about impact.

These assumptions have been challenged on various accounts (Schot and Rip, 1997). The idea that technological developments can be more or less predicted by extrapolation or other means, turned out to be over-simplistic. The notion of predictability apparently does not align with a further understanding of the non-linear and indeterminate processes of research and innovation. Others have questioned the legitimacy of experts' knowledge to decide what is at stake and this should be weighed against other values.

Later versions of TA stressed the importance of other sources of knowledge and sought to include stakeholders to accommodate their perspectives and values. This counteracts the notion that experts have privileged access to good judgment and sound policies. The basic idea is that the participation of stakeholders warrants a more democratic, and thus better, policy and/or innovation process. The risk here is to identify with the particular interests of the stakeholders, rendering TA into politics with other means.

So-called Constructive TA also includes the merits of stakeholder inclusion, but conceptualizes the innovation trajectory as a series of decisions which can be improved by including more factors and actors. Its perspective is to optimize the design of new technologies. The merit is not so much a more democratic process, but a better process of co-construction: 'a better technology in a better society'.

Responsible Research and Innovation (RRI), in contrast, does not yet have a history with strands, approaches, institutional forms, and experiences. So, it is more difficult to flesh out the philosophies and assumptions. Yet, its career through the realms of national and European policy is impressive and provides already some material to reflect on. Clearly, it is an umbrella term which connects different interests and viewpoints (Owen et al. 2013, Rip 2014). From one perspective the ethical aspect of new technologies is stressed: they do not just produce new risks and benefit, but they alter the symbolic or moral order as well. Such changes are less tangible, yet profound and require additional attention and reflection. The idea is that reflection on research and innovation should incorporate normative ideals. The perversity of this renewed interest is already visible as well: RRI as a means to secure the fate of innovation – as long as they can be marked as 'responsible', their uptake in firms, economic sectors, and society at large can be expected to be successful. Table 4 provides a rough summary of the assumptions and perversities of TA and RRI.

	Focus & Goal	Epistemological Source	Political Legitimation	Perversity
TA (old)	impact	experts (esp. economics and engineering)	mobilizing science	marginalisation of relevant aspects
TA (new)	inclusion	the public/citizens	serving democracy	tight link to stakeholders' interests
CTA	design	TA agents	enhancing reflexivity	capture of TA agents and assimilation to technologists
RRI	outcomes	ethical brokers	adhering to normative ideals	naive instrumentalisation (checklist)

Table 4: Assumptions and perversities of TA and RRI

It is tempting to see RRI as a next step of TA, or even as the same ambition in other terms. For example, the PACITA Project Manifesto that was stated during the second PACITA conference (Berlin, February 2015) voices this interpretation explicitly:

"Responsible Research and Innovation has shaped the last year's policy discourse in Europe related to the societal role of research and innovation. It has given key concepts in TA, such as participation, forward-thinking, reflexivity and policy action, greater focus. TA can and should be a key carrier of the concept and play a light-house role in RRI."

We do not intend to discuss the veracity of this interpretation. Instead, we suggest using the emergence of RRI as a possibility to reflect on the ambitions of TA and its possible white spots. In this sense, we suggest the thought experiment to consider RRI as a critique of TA. We follow this thought on two accounts: the re-appreciation of ethical deliberation and the ambiguous consultation of stakeholders.

Ambiguities and Ethics

Following this thought experiment, we can argue that what makes RRI stand out as really different from previous forms of TA is that RRI takes ethical controversy seriously. The way traditional forms of TA avoid moral controversies is by either downplaying them – by focussing on some key moral values like safety or health, that as sufficiently shared as to not stick out as a sore ethical thumb – or by delegating/outsourcing them – to politicians (in the case of expert-driven TA) or to the citizens/stakeholders (in newer TA forms). One way to put this is that TA deals with all kinds of anticipation, ranging from hazard, risk, uncertainty, ignorance, indeterminacy, to, finally, ambiguity. In all these cases, all but one of the variables are epistemic, relating to what will happen, and not ethical, relating to whether what will happen is to be deemed desirable. Only ambiguity, which seems usually treated as a problem that only manifests itself at the end of the line (when we have dealt with the other problems, then we have to deal with ambiguity), deals with this ethical, as opposed to moral, dimension.

In other words, RRI does not distinguish itself from TA in its orientation towards established moral values (either as boundary conditions or as aspirations), but in its openness towards moral ambiguity. And asking how RRI became prevalent amounts to asking: how did ambiguity become prevalent?

So, if we want to highlight the rise of RRI from the ethical point of view, we have two key explanations: we move from a protective/reactive ethics of harm avoidance to an aspirational ethics of value maximisation; and from an approach that orients itself towards realizing established, non-controversial moral values (which are therefore not recognized as such) towards an ethics of ambiguity – that is: a situation where there are no simple solutions but at best tragic value trade-offs.

Stakeholder Participation and Orientation

Papers on RRI generally refer to stakeholders' engagement in research activities and/or in innovation processes as one of the key dimensions of RRI. For example, von Schomberg (2013) points out the need for TA and foresight in RRI, together with multi-stakeholder involvement and deliberative mechanisms; Stilgoe et al. (2013) identify inclusion as one of the four dimensions of responsible innovation, together with anticipation, reflexivity, and responsiveness.

A look back at stakeholders' involvement in TA practices is informative since, on the one hand, the mantra of participation in RRI has the same origins as in TA and on the other hand, we can draw useful insights from the historical experience of TA. The original model of TA institutionalised in the US through the creation of OTA in 1972 did neither include public nor stakeholders' participation. It was assumed that experts' knowledge dedicated to the study of intended and non-intended impacts of new technologies would be enough to provide political representatives with a useful tool to govern science and technology. When parliamentary TA was institutionalised in different European countries, some countries introduced what was called the 'participative turn' of TA. Denmark and the Netherlands have been at the forefront and have implemented public participation with some important differences. The Danish Board of Technology (DBT) is well known for having invented the 'consensus conference', the model of public participation that gained widespread attention. Consensus conferences are designed to mediate the relation between scientific expertise and public policies. One of the key characteristics is that this mediation is public. Hence, through a mix of inspiration from Rawls and Habermas, public participation is designed as a way to perform a dialogue on science and technology in the public sphere, in order to elicit public will. The Netherlands Office of Technology Assessment (NOTA – which later became Rathenau Instituut) experimented with models of public participation that had a slightly different inspiration, namely deliberative forums constituted by 'mini publics', but they are not organised with a panel of lay people at their core (Schot and Rip, 1997). They are designed to spur interactions between different stakeholders, including researchers and professionals involved in the subject area. The basic belief is that this hybrid deliberation may improve the production of knowledge and provide relevant insights into useful and societally relevant orientations of research and innovation processes.

Of course, differences between countries are less clear-cut than they may look at first sight. DBT and Rathenau Instituut (to stick to these two organizations) have used a set of devices that aim either at enriching public debate or at co-production. However, the distinction is important from an analytical point of view. According to Callon et al. (2009), the second model (co-production) rests on the active work of concerned groups who problematize and challenge the production of knowledge and develop collaborations with various labs to find some solutions to their problems. In such a model, the identity (and the objectives) of the groups concerned may evolve in the process of collaboration – patients' associations are the emblematic example here. Research objectives and societal needs are co-constructed during the process of interaction.

At first sight, one could argue that the co-production model of public participation offers more advantages and less risk than the model of public debate. One could also argue that interactions of stakeholders and researchers at bench level (so to say) are more productive and more able to contribute to the reflexivity of researchers. However, this appraisal may be challenged on different grounds. First, the scale and the scope of such interactions are intrinsically limited. At the scale of the project or the laboratory, some major issues related to power relations or regulation of the research activity may be dismissed. A critical discussion of the frame within which research is designed (the future social words related to broader interactions between science, technology, and society, etc.) may be limited because such a frame is considered as irrelevant at this scale. This may have two implications: for one thing, the inability to raise important questions, but also an overestimation of the potential of reflexivity (one of the key dimensions of RRI) to transform behaviour and norms of researchers.

Second, stakeholders' engagement raises the issue of representation. These approaches do not necessarily aim at including actors who represent the whole society (whichever it is), but are limited to those who have a stake in the issue discussed. However, the question whether actors invited have the same interests and concerns as those who are not is a difficult one. The criteria of the diversity of groups included is interesting, but of limited practical utility, especially for new emerging technologies because their publics are not constituted (to refer to Dewey). This may limit the legitimacy of these mini-group exercises when public funds or public decisions are involved.

The third limitation is closely related to the former one. Stakeholders' dialogue may work in an idealised flat world exempt from strong power asymmetries, a world of distributed governance. In such a vision, the roles of the State and government bodies have to be limited. Their role is to foster interactions and learning processes, to empower actors and create conditions that favour innovation (whichever direction it takes). This conception of the polity (closely related to neo-liberalism) is currently challenged in many respects. There are many reasons to 'bring the State back in', including the need to address Grand Challenges, which appears as a cornerstone of current research and innovation policies. As Grand Challenges are one of the anchor points of RRI (responsibility of research and innovation is to contribute to the solutions of major problems), stakeholders' engagement should not be viewed as a substitute to government regulations but as a key piece for the government of innovation.

These limitations should not be viewed as a definitive rejection of TA, but instead as a starting point that may help to better design stakeholders' dialogue and public participation in the context of RRI. As a provisional (and partial) statement, several critical points may be formulated. First, one should not oppose model 1 to 2. They are complementary and instrumental for dealing with the issues at various scales and articulating local dynamics and public policy in the making. Second, it is important that such exercises have the ability to produce knowledge on the web of power relations and strategies within which they take place. And third, these exercises should be designed in a way that allows a serious dealing with the directionality of innovation without the implicit assumption that technological innovation is a good as such.

Conclusion

In this paper we followed the possible interpretation of RRI as a critique of TA. In this way of reasoning, TA can be said to neglect moral ambiguity and to downplay the desired direction of innovation. This interpretation resonates with the diagnosis of Daimer et al. (2012) of the evolution of innovation policies of the last decades. While market failure has been a general rationale for policy making since the 1970s and system failure was added as a second rationale, they note the rise of 'orientational failure' as an additional rationale for policy interventions. In this sense, RRI is a response to the orientational failure of TA, and could be interpreted as an urge to include normative concerns about the societal goals of innovation.

References: Page 419

PUBLIC PARTICIPATION FOR COMPLEX POLICY PROBLEMS

Articles from the PACITA 2015 Conference Sessions:

(01) Engaging Citizens in E-Participation and Policy Making on the National Level
(11) Public Engagement in Responsible Research and Innovation
(16) Approaching Synthetic Biology for Societal Evaluation and Public Dialogue
(26) Public Participation for Complex Policy Problems: Challenges and Recommendations

Assessing Stakeholders' Needs and Constraints Related to RRI

Experience and First Results of a Pan-European Stakeholder Consultation

Ilse Marschalek

Abstract

Responsible Research and Innovation is an emerging concept which does not yet have commonly agreed characteristics and standards. To understand and apply the complex concept there is a great demand for guidance and training. The main objective of the current EC funded RRI tools project is to develop and apply a training and dissemination toolkit on RRI. It follows an inclusive approach, consulting different stakeholder groups on their needs and concerns so they can be considered in the development of the concept and the toolkit. A stakeholder consultation method was carried out which collected initial results on the main obstacles and opportunities as envisaged by the different groups.

Introduction

Although there is not yet a final, commonly agreed framework for RRI (Owen et al., 2012; Stilgoe et al., 2013; Owen et al., 2013), one main aspect seems to already be taken for granted, namely that RRI is a process where all societal actors should work together during the whole process in order to align its outcomes to the values, needs and expectations of European society. The importance of stakeholder involvement is growing in various fields, but the involvement of stakeholder groups at an early stage is even more important for developing an integrative concept - such as that of RRI - in a participatory manner (Human and Davies, 2010).

To build wider communities of practice across Europe in the future, the consultation method introduced here integrates stakeholders so that they can contribute initial contact points to raise awareness and promote involvement. It therefore serves both objectives: to introduce stakeholders to the RRI concept and to enable them to employ a common understanding of the RRI concept, as well as to extract information to be used in future elaborations of the concept. The RRI tools project applies a bottom-up approach to make sure that dimensions and criteria of the toolkit meet the requirements and needs of the stakeholders and thus enhance the probable adoption of the concept as much as possible.

The RRI Tools Project

The RRI tools project (www.rri-tools.eu) is a three-year EC project funded with its main objective to foster Responsible Research and Innovation in Europe. This project is developing and using a training and dissemination toolkit on RRI. It is being addressed to and designed by all the stakeholders across the research and innovation chain of value. The toolkit will contain an innovative and creative set of tools comprising practical digital resources and steps aimed at raising awareness, training, disseminating and implementing RRI. Tools will be based on collective reflection and built on good RRI existing practices (Kupper et al., 2015; Klaassen et al., 2014).

RRI Tools is a collaborative and inclusive project, whose aim is to increase creativity and shared ownership of the process. Its ultimate goal is to establish a community of practice in Europe to ensure the use and evolution of the toolkit. In order to build them, the project consortium consists of 19 national centres – so-called hubs – that are responsible for opening participation to a maximum number of stakeholders.

The Stakeholder Consultation Method

The stakeholder consultation methodology was an essential approach for ensuring that the future RRI toolkit would take its future users' needs and constraints into account. The challenges of this consultation were diverse. It is supposed to consider a wide range of stakeholder profiles, each playing a different but related role in the RRI process. It also has to be applicable in a variety of settings in order for all the hubs of the project to be able to implement it successfully. It had to deliver clear and standardised results that could be centrally analysed afterwards. And it had to be clearly linked to the work of the initial phase of the project in order to ensure stakeholders' needs and constraints are collected according to the project's agreed and understood working definition of RRI.

After a mapping of stakeholders, the following groups have been identified and described in more detail to be applied for recruitment: civil society organisations (including foundations, associations, social movements, community-based organisations and charities); the media; the education community (both informal and formal, from ministry to school level); industry and business representatives from various fields (with in-house or outsourced innovation departments and/or with some R&I base); policymakers (including funding agencies, regulators, and executive); and researchers and innovators (affiliated with various institutions and organizations on different levels).

The methodology was then developed in order to be implemented across all hubs. The consultation took the form of heterogeneous group workshops, bringing all stakeholder groups together in order to take advantage of group dynamics and collective reflection,

while still ensuring that the voice of each stakeholder group in each hub area was heard (Baur et al., 2010). The consultation methodology (Creek et al., 2014) finally consisted of:

- An in-depth stakeholder identification process according to the stakeholder mapping
- A recruitment process of identified stakeholders as consultation participants, but also awareness raising, building up the communities of practice (CoP) and recruiting survey participants
- A consultation workshop with selected representatives of stakeholder groups
- A short follow-up e-mail survey to validate/complement the results

The core element of the methodology was a multistakeholder workshop, attended by representatives of all the targeted stakeholder groups. Mainly, the goals of the workshops were:

- To discuss the RRI working definition
- To collect and evaluate promising practices
- To assess stakeholders' needs and constraints when putting RRI into practice

This structured workshop format needed to be facilitated according to guidelines within a tight timeframe to ensure that all the objectives could be addressed sufficiently. Workshop guidelines in the form of a comprehensive consultation manual therefore had been designed to offer a set of different techniques and exercises that would best help stimulate and steer discussions and, at the same time, provide structured and visible outcomes. Workshop moderators were also invited to take part in a training session and an experimental workshop to run through the exercises. However, the workshop format was rather easy to employ, helping to ensure it could be replicated at the different hubs, which finally proved to be correct.

Across Europe, 27 workshops could have been conducted. All the workshops took place between September and December 2014 and involved 411 participants with an almost equal number of each gender (52% male, 48% female) and of each stakeholder group, as shown in Figure 3.

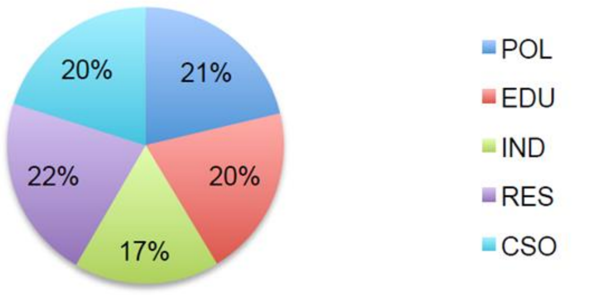


Figure 3: Workshop attendees by stakeholder group

Results

Summarised results of the consultation process are shown in this section, beginning with opportunities identified across the stakeholder groups, followed by the main obstacles that could hinder the successful implementation of an RRI process and finally the collected needs and actions to be taken (Smallman et al., 2015).

Opportunities

Figure 4 shows the seven clusters which were identified by the workshops:

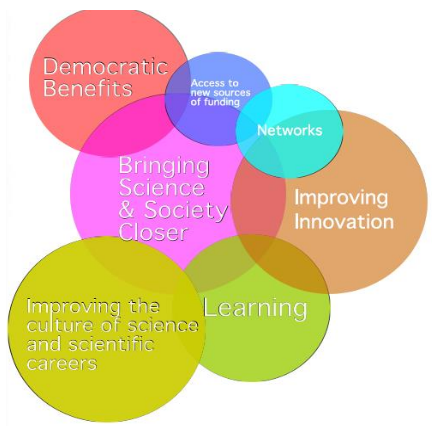


Figure 4: RRI opportunities across stakeholder groups[1]

- <u>Bringing Science and Society Closer</u>

Building trust between science and society was seen as very important, particularly in the light that this trust had been eroded in the past. RRI asks for a two-way exchange between science and society, which could bring science and society closer together. Transparency was therefore seen as a powerful opportunity to bring science and society closer. Furthermore, RRI provides the opportunity for shared responsibility across stakeholders via engagement processes, even during the early stages of RRI activities. This public engagement would also create a shared sense of ownership on RRI outcomes and trust in policy decisions. Through a variety of formal and informal streams, it could also contribute to improving the image of science in society. RRI would also stimulate long-term thinking and enable a better assessment of societal expectations.

- <u>Improving Innovation</u>

In general, the potential for RRI to generate new products and reach new markets was highlighted. Products would become better adapted to consumers' needs. However, incentives have to be created, as would a political commitment to long-term business

strategies. As a RRI process would stimulate creativity through its flexible and inclusive approach, it would create more relevant and problem-oriented innovations.

- <u>Improving the Culture of Science and Scientific Careers</u>

RRI could contribute to changes in the self-understanding of science and scientists. They would recognize that they work as part of a wider system and thus could make a difference through their work, and by directly engaging with users of their research they could also generate problem-oriented research. This could also attract more young people into scientific careers. Furthermore, new training opportunities according to RRI and incentives for interdisciplinary approaches would support cross-sector research. New evaluation criteria according to RRI quality standards would also influence the assessment of the impact of research. Revised peer-review processes and open access practices are seen as important disclosure strategies.

The following clusters have also been identified: democratic benefits via new process standards, better support for traditionally under-represented groups and for more informed and engaged citizens, new learning opportunities, opportunities via new networks, and access to new sources of funding.

Obstacles

Stakeholders also discussed the main obstacles (as shown in Figure 5) that they see from their perspective, and finally, nine clusters were identified.

Figure 5: Obstacles by relative size/importance across stakeholder groups

- Attitudes

Participants envisaged a great obstacle to be the lack of "buy in," – i.e. the acceptance of the RRI concept. Benefits would have to be made clear such as in the form of formal recognition, incentives or clear career benefits, or a requirement for RRI should be created, but obviously this controversy causes tension. Resistance to change was also identified as an obstacle, especially in large systems or hierarchies where there is not much interest in change or a lack of confidence in it. A common tendency to short-term thinking, especially in political cycles or governmental funding, and risk aversion because of the possibility of creating a public controversy were seen as important issues. Furthermore, unwritten rules and norms of the respective culture were mentioned as possible obstacles.

- Culture

In addition to the cultures in the different realms, such as the disciplinary boundaries in the scientific realm, participants mentioned a lack of innovation culture in general as well as a lack of a collaboration culture across stakeholder groups.

- Knowledge

Another big cluster was knowledge on RRI. There is still a lack of consensus on a definition, a lack of clarity over the definition and a consistent RRI concept, and a lack of understanding and thus of how and when to employ it. Participants felt an absence of norms, regulations and examples of good practice. RRI also asks for augmented personal skills and a language that helps communication between stakeholder groups.

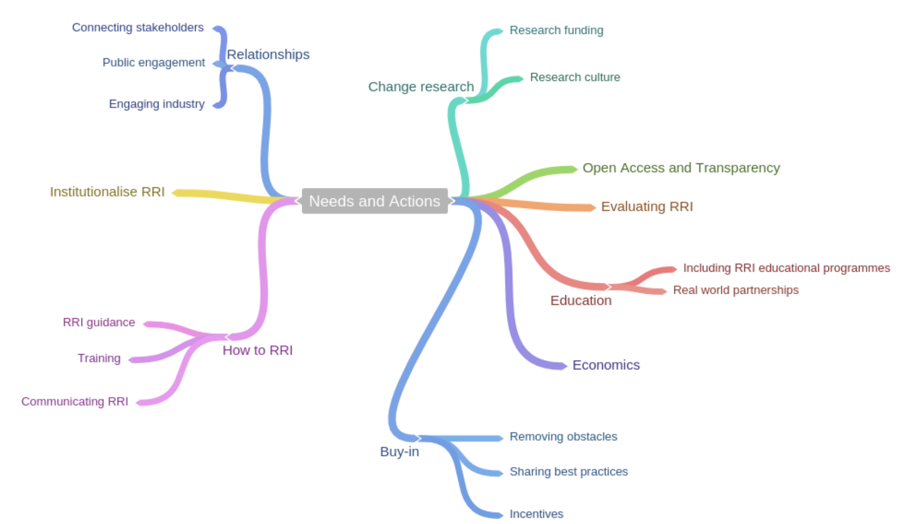


Figure 6: Needs and actions across stakeholder groups

Furthermore, the lack of relationships required for RRI processes were mentioned. The mismatch in power between different groups, the lack of networking opportunities and coordination, as well as lack of accessibility to certain groups, particularly to industry, were seen as obstacles. Naturally, a lack of resources of all kinds was mentioned, as was the economic crisis, less public funding, the additional costs of RRI processes, and a nonexistent valorisation of the RRI benefits.

Actions Needed

Based on the opportunities and obstacles that were discussed, nine clusters of needs and actions (as shown in Figure 6) were identified. Analysis of the results will be used by the project to feed the production of the toolkit.

Conclusions

From a methodological point of view, bringing the different stakeholder groups together at one table can be seen as fruitful first step towards future cultures of collaboration as required by the RRI concept.

The results show that there is little knowledge of RRI and that the concept is abstract and difficult to engage with. However, there is a considerable enthusiasm and optimism about RRI. The obstacles clusters of the different stakeholder groups overlap, as do the opportunities, but some actions need to be stakeholder specific (see all the details for groups and countries in the report Smallman et al., 2015). Generally there is a need across all stakeholders for a clear definition and "how to" guidance.

Across stakeholder groups, RRI is regarded as a serious and transformative activity rather than as a modest tick box exercise. RRI is viewed with high aspirations, and changes in views on normative values are expected. All the stakeholders consider RRI to offer an opportunity for them to discuss the type of world we want to live in in the future.

References: Page 419

Limits of Public Participation for Complex Policy Problems

Individual Freedom vs. Common Interest in the Context of Building Wind Energy Farms

Ulrike Bechtold and Harald Wilfing

Abstract

Whenever commons are at stake, participation is classically required: land use (patterns), energy (generation), and air (pollution) are commons that affect everyone. Decisions made here concern the location, management, and hence the distribution of advantages and disadvantages. Such decisions require public legitimation. One way to provide for this is to organize public participation exercises. We aim to rethink this somewhat unidirectional connection and examine the limits to this reasoning. Focusing on implementation processes preceding the construction of wind energy plants (WEPs) in Austria, we aim to illustrate these borderlines. We want to sketch diverse but tightly interconnected driving forces and motivations of those in favour of and those opposing the building of a wind farm. To what extent are the correlations mentioned above prone to "abuse freedom"? In other words, under what circumstances is participation abused to enforce the interests of single stakeholders? Our analysis identifies some serious obstacles in terms of a green energy transition.

Introduction

What is the significance of the individual's liberty in relation to the requirements and necessities of a sustainable society? To what extent is the individual's freedom the main cornerstone of action, and where exactly are the limits when the interest of the community is opposed to an individual's interests? In other words, when does a common interest (e.g. sustainable development) outweigh individual freedom (cf. ‚e.g., Kahane et al. 2013)?

In view of the remarkable analysis of the societal state in times of "Post Democracy" (Crouch 2004), public participation in decision-making processes deserves careful attention and rethinking. People's interest in participating in democratic decision-making processes is currently declining. As a result, information transfer, which is necessary to allow informed decisions, is critically and frequently being underestimated (see also Gudowsky and Bechtold 2013). The importance of the specific knowledge of the participants, and hence of decision-makers, should therefore be re-emphasized: less interest in the process itself goes along with less interest in the general issues at stake.

This observation can also be seen as a fundamental challenge regarding the green energy transition (Pegels and Lütkenhorst 2014; Monstadt and Wolff 2015). The question of the role of expertise is inevitable: how easily can a process be corrupted by even irrational arguments brought forward as loudly as possible by, mostly self-proclaimed, "experts" who merely represent their own personal interests (e.g. "not in my backyard"[1])? This is emphasized by the framing of participants as "experts of the practice" – hence the old slogan of the Enlightenment, sapere aude! (=dare to be wise) (Kant 1784), becomes important again.

Focusing on implementation processes preceding the construction of WEPs in Austria, we aim to illustrate the borderlines mentioned above. We want to structure the diverse but tightly interconnected network of driving forces and motivations inherent to arguments in favour of or opposing the building of WEPs. To what extent are the correlations mentioned above prone "to abuse freedom"? In other words, under what circumstances is participation abused to enforce the interests of single individuals or particular stakeholders, leading to serious obstacles regarding a green energy transition?

We think it is important to raise the critical question whether participatory processes can cope with these challenges or if they reveal a certain limit to participatory processes. In order to specify this question more clearly, we distinguish between a process and a methodological level.

Green Energy Transition and Levels of Involvement

On the EU level the 2020 climate and energy package[2] contains the "20-20-20" goals: a 20% reduction in EU-wide greenhouse gas emissions from 1990 levels; raising the share of EU-wide energy consumption produced from renewable resources to 20%; and 20% improvement in the EU's energy efficiency. As an accepted EC document it is based upon agreements which are no longer open to discussion. In accordance with the EU strategy, all national plans contain a comprehensive restatement of these goals.[3] Interestingly the regional level, at least in Austria, reveals positions that already vary (depending on the context), and the local level is marked by tangible conflicts of interests (NIMBY, financial interests, etc.; for the different nature of such conflicts and their exploration see also Wolsink 2005; Ellis et al. 2007; Nadai 2007; Wüstenhagen et al. 2007; Cowell et al. 2007, Swoford and Slattery 2010; Hall et al. 2013).

The Aarhus Convention[4] provides a legislative framework, which is an important foundation for public involvement. Considering the Aarhus Convention, it becomes evident that the EU administration encourages public engagement and energy plans are taken for granted – legally, the (supra) national plans are accepted. However, this does not solve the problems

likely to occur on a local level. Locally, concrete measures are open to public discussion. When regional conflicts of interest arise, the position may change considerably. We saw this in the case of the governor of Lower Austria: as soon as opposition began to form, the construction of a wind power plant was stopped.

One of the main expectations of public participation is that it will secure a legitimate process and improve the legitimation of decisions (which affect the public). As this happens, information flows and knowledge exchange take place (Gudowsky and Bechtold, 2013). However, looking at participatory processes preceding the building of WEPs, at least four major topical challenges can be identified. All of them relate to the meta issue "individual freedom vs. common interest/sustainability" and can be identified as potential limits to participatory processes.

1. ***Aesthetics of wind energy plants:*** The belief that WEPs spoil the characteristic landscape can be seen either as a general killer argument or the cause of almost infinite aesthetic discourses. Traditional windmills are nowadays regarded as a scenic value of a landscape. In the past, such grain mills, water mills, and saw mills were spread all over Europe. In the 15th century the Netherlands started to drain huge areas, and by 1700 the north of Amsterdam counted approximately 1,200 windmills for different purposes; by 1850 there were already 9,000 windmills. In Germany there were 20,000 mills at that time. For the whole of Europe the figure was about 200,000 (Hau 2014). Interestingly, this number of modern on-shore wind energy plants will not be reached in Europe until 2020 (Klessmann et al. 2011).

2. ***Declining public interest vs. broad integration of "experts of the practice":*** A decline in public interest (Crouch 2000) is especially dramatic if the public are taken seriously and, by being incorporated into the decision cascade, regarded as experts on their everyday life and home territory. On the one hand, this situation can lead to the effect that only a handful of concerned persons may control the process. On the other hand, the authorities can misinterpret such a lack of public interest as a kind of tacit acceptance.

3. ***Dealing with proxy fights:*** The problem field of "proxy fights" is likely to occur because the local public are necessarily closely connected with local history (lock-ins and path dependencies may occur). These dynamics may cause irrationalities in the arguments which cannot be solved in immediate participatory processes bound to a not yet familiar thematic issue (like wind energy). Participatory processes related to WEPs serve as perfect arenas for such "proxy fights" (Fliegenschnee and Maringer 2015). However, previous experience with WEPs has increased public acceptance (AEE 2014).

4. ***Dealing with "false truths":*** Subsonic noise, which is produced by WEPs, can be taken as an example here. It is widely believed that this kind of inaudible sound has harmful effects. From a scientific point of view it has to be stated that at a distance of 100-250 m WEPs produce max. 50-70 dB. Each doubling of this distance implies

another reduction of 6 dB. Considering that the construction regulations for WEPs usually prescribe a minimum distance of at least 500 m to residential areas, it has to be stated that the sound pressure of a WEP at a distance of more than 500 m is negligible compared to other sources (wind, road traffic, etc.). So far, there is no scientific proof of physical effects from WEPs. A study carried out by the Landesgesundheitsamt Baden-Württemberg states unambiguously: "WEPs are definitely not 'loud' subsonic sources. Beyond the minimum distance for noise prevention of 500 m, the subsonic noise lies significantly below the limits of perception. Regarding the currently used standards of evaluation, WEPs can be seen as unproblematic." (www.gesundheitsamt-bw.de 2012). As mentioned above, other significant sources of subsonic noise, for instance driving a car or ocean waves, are not seen as injurious to health. One rarely hears complaints about people getting headaches while sitting at the beach and watching the waves (DIN 45680 1997).

In this context Crichton et al. (2014) describe the so-called "nocebo effect" during an experiment where participants were divided in two groups. Half of them were informed about the possible adverse effects of subsonic noise, the other half was not informed. Then half of each group was exposed to subsonic noise, the other half not. Interestingly, the informed group perceived subsonic noise without being exposed to and, amazingly, some of them even perceived it as harmful.

Another prominent argument against the construction of WEPs is the phenomenon of bird strike. Here too, the level of bird strike caused by sources other than WEPs remains unacknowledged. Negin (2013) lists different sources of bird strike in the US in 2012 as follows: buildings (970 m), power lines (175 m), misapplied pesticides (72 m), communication towers (6.6 m), gas/oil waste pits (1 m), whereas WEPs account for 573,000 (!). For Canada another source says that domestic and feral cats cause about 200m bird victims, vehicle collision causes 14m, and agricultural mowing kills 2.2m nestlings (equiv. 1m adult birds) (Calvert et al. 2013).

Conclusions

The tightly interconnected network of driving forces and motivations inherent to arguments in favour of and opposing the building of WEPs as sketched above display an enormous power to disturb and corrupt participatory processes ahead of the construction of wind energy farms. We can therefore distinguish between implications on the process and the methodological level.

Process Level

The responsible local decision-makers might be inclined to throw the baby out with the bathwater: the number of participatory approaches could be reduced or they could even be abandoned.

Why? Energy plans are taken for granted, but on the local/regional level concrete measures are prone to discourse and conflict. Local/regional authorities face a threefold challenge:

- They have to contribute to the (supra)national quotas of renewable energy sources
- There is an increasing demand for (mandatory) participation
- Participatory processes have to deal with two aspects:

1. topical issues (place, height, construction details, yield, proximity to …, vicinity of …, sound, energy quota, profit sharing, …),
2. local peculiarities and histories (path dependencies & lock-ins), goal conflicts, prejudices, and irrationalities such as "proxy fights".

Participation has to take place, since it is becoming increasingly mandatory and there are justified expectations that transparency in the run-up to processes and the active involvement of all those affected may facilitate the process and/or increase public acceptance. However, apart from the factual level, irrational components may also play a role and "proxy fights" are likely to be fought at the level of participation. Hence, if they remain unacknowledged, there is a risk that participatory processes may fail.

Methodological Level

An important aspect here is the phenomenon that a neutral and interested majority can easily be unsettled by a minority of persons – if the process is held in plenary sessions – (pers. comm. Fliegenschnee and Maringer, 2015). Larger participatory processes need thorough organization and should provide the capacity to deal with large numbers of participants (e.g. the World Wide Views approach as described in Rask et al. 2012). It seems important that the individual participant does not have "plenary power" – in other words, individual participants are not given the floor. The participants listen to plenary information, but their deliberative work takes place in small and facilitated groups. The facilitator has the difficult task of remaining entirely neutral in terms of content, but being strict in terms of structural rules. Hence (s)he can provide each participant with time, security, and respect to be able to express their concerns in the group. The facilitator takes care that no individual dominates the discussion and guarantees that controversial suggestions and arguments are discussed and commented on by (all) other participants around the table. In this way the controversial arguments are heard and given room, and in the final visualization of the process outcome they are appropriately taken into account. They co-exist with a huge number of other aspects generated by all the other participants.

If local/regional authorities continue to convoke open and (methodologically) large(ly) unorganized processes, there is the danger that they will be hijacked by irrational arguments and the voices of the majority of interested participants will be drowned out by local peculiarities, irrationalities, and/or negative prophets and advocates of false truths.

If these challenges and multiple pressures remain unaddressed and participatory approaches are not able to deal with them adequately, this may have severe consequences: there is a risk that participatory processes will be abused and, in the end, abolished because they are perceived as ineffective.

Finally, it should not be forgotten that nothing less than sustainability and the green energy transition are at risk.

References: Page 420

The Study Commission "The Internet and the Digital Society" in Germany

Britta Oertel, Carolin Kahlisch and Michael Opielka

Abstract

The Internet is developing into an increasingly significant platform for debate about politics and questions for the future. In this regard, participatory processes such as online civic participation are gaining in importance. They create new opportunities to exert democratic influence. The German Bundestag put civic participation in political processes to the test with the help of innovative and Internet-based measures in the context of the "Internet and the Digital Society" study commission ("Internet Enquete" for short). Following the work of the Internet Enquete, scientific analyses on the new working practices were carried out by the Office of Technology Assessment at the German Bundestag (TAB).

Using the example of the Internet Enquete, the results of the IZT – the Institute for Future Studies and Technology Assessment – paint an overall positive picture of online civic participation in parliamentary work. The dialogue platform www.enquetebeteiligung.de functioned reliably and, as a test bed, set important priorities for the work of the Study Commission. Despite an overall positive assessment of the new approaches, civic participation by citizens has nevertheless remained below expectations. Internet and IT-based social media can intensify deliberative processes in parliamentary work. However, the modes for selecting the topics debated and the distance from political decision-making processes ask for further innovations.

TA Project: Online Civic Participation in Parliamentary Work

The Internet changes political communication and, with it, civic participation in political processes and decisions. In the first instance this happens through the emergence of a group of digital citizens with Internet-based communication routines. This group emits impulses which lead to a structural change in political communication (Vowe 2014, p. 25). Internet-based dialogue, consultation and participation platforms which allow active participation by interested players were established in Germany primarily by the political parties but also by the Federal Government. Examples of this can be found in all the parties in the German Bundestag.

Online participation platforms create new opportunities to exert democratic influence by making offers of information and participation publicly accessible, linking to content contributions – also using different Internet applications – and opening new routes to interactivity. They expand upon the opportunities of earlier formats, in which information and communication were the focus, with dialogue, voting or even collaboration functions (for example for member participation in programme debates or for suggestions and online proposals). This raises the initiators' hopes and expectations for promoting democratic ideas through increasing online participation.

In 2010, the German parliament put the focus on the topic of "Online civic participation" in the context of the "Internet and the Digital Society" study commission (in short, Internet Enquete). The commission tested various innovative measures such as setting up and operating an online participation platform and a blog. A retrospective scientific assessment of these measures is being carried out by the Office of Technology Assessment at the German Bundestag (TAB).

In the spring of 2014, the first results were presented in the form of a preliminary study titled "Online civic participation in parliamentary work" (Oertel, Kahlisch, Meyer 2014). The study followed a request by all fractions of the Internet Enquete, who concluded in their meeting of 28 January 2013: "...to archive the information recorded in the online participation tool 'enquetebeteiligung.de' so that access to this information... is guaranteed in the long term and this can also be used in its entirety by the TAB for a scientific evaluation of civic participation" (Deutscher Bundestag 2013). To meet this request, the German Bundestag Committee on Education, Research and Technology Assessment (ABFTA) concluded in the summer of 2013 to commission the TAB to establish a preliminary TA study to carry out initial scientific analyses as a follow-up to the work of the Internet Enquete.

The preliminary study was developed from 2013 to 2014 by the IZT. The IZT has been a consortium partner of the Office of Technology Assessment at the German Bundestag. Based on the information from the preliminary study, ABFTA concluded on 2 July 2014 to allow the topic to be further worked on by TAB in a larger TA project. This article presents selected results of the preliminary study.

The Office of Technology Assessment at the German Bundestag had already conducted studies on the topic of participation or studies that accompanied the introduction of electronic and public petitioning.

Novel Approaches for the Bundestag's Parliamentary Work

The study commission on the "Internet and the Digital Society" was unilaterally implemented by the German Bundestag in March 2010. The committee was composed of 17 members of parliament and 17 external experts. It finished its work in the spring of 2013.

The study commission worked in twelve project groups, which focussed their work on topics such as net neutrality, data protection, copyright and media competence. The study groups started their work at different points in time (see Figure 7).

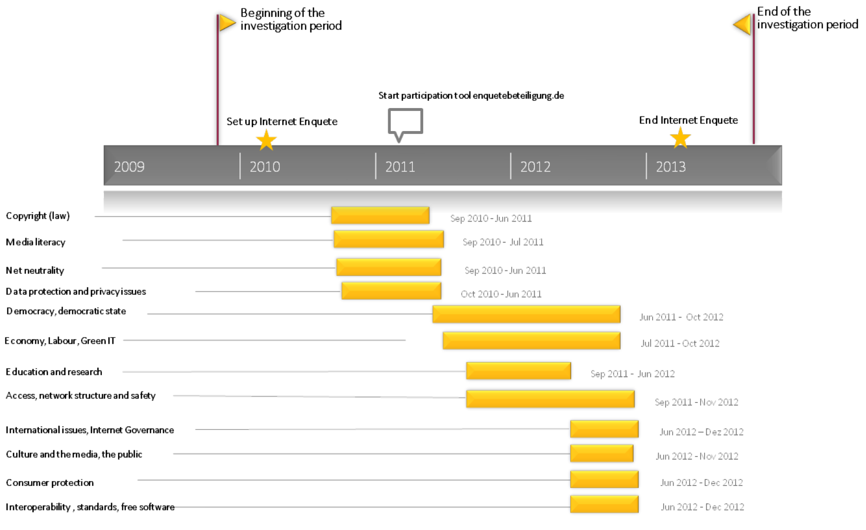


Figure 7: Study commission's timeline and topics

Author's diagram IZT – Institute for Futures Studies and Technology Assessment

The resolution itself contains an assignment which is novel for the parliamentary work up to that time; it focuses on civic participation in the commission's work. In their report of their results, the Internet Enquete documented in detail the approach, tools, challenges and the experience of commission members with online civic participation. The final report also dedicated itself mainly to the participatory experiences. It identifies the work of the commission as a test bed for the search for new forms of political discourse. Using the model of the "18th expert", the public is to be continuously included for the first time in the work of the Study Commission of the German Bundestag (Deutscher Bundestag 2010).

This meant an Internet presence reporting information on the progress of the study commission's work that is updated on a daily basis and broadcasting its meetings either live or subsequently so that citizens could personally take part in project meetings or at least experience them. A blog was set up in which members could present their points of view on the work of the commission and discuss them with citizens. The office of the Internet Enquete provided timely information and answered questions on the microblog service Twitter. Members of Parliament and experts of the study commission also engaged in dialogue in various blogs and on Twitter.

The German Bundestag's Internet presence started a discussion forum and later, after the work of the first four project groups had started, the dialogue platform www.enquetebeteiligung.de was set up. Interested private individuals and later also organisations could submit proposals or opinions to the Study Commission via the dialogue platform.

The participation platform EnqueteBeteiligung.de was activated 24 February 2011 – after a somewhat controversial discussion. Publically, the controversy revolved around the fact that EnqueteBeteiligung.de could only be established through voluntary commitment in cooperation with the charitable organisation Liquid Democracy. However, the requirements and the guidelines of the Internet Enquete and the German Bundestag were taken into account. The new participation platform is based on the open source software "Adhocracy" (www.adhocracy.org) and little by little replaced the discussion forum (Bundestag microsite).

Civic Participation in the Dialogue Platform

The invitation to citizens to participate online also influenced the Internet Enquete office's public relations and the members of the Study Commission in that mainly the Internet public was addressed. Embedding links in pages with high user traffic (including social media) is relevant for the success of every Internet service. These sources raise awareness of a service and make it easier for Internet users to quickly reach the service by clicking a link. To announce the participation platform, the members of the commission use their own blog and the discussion forum, which was active up to that date. As of May, 2011, news briefs were posted on Twitter predominantly. "Recommended course of action #Copyright law at the Internet Enquete: still time to vote this week!" is an example from May 2011. "Get involved in the Enquete – where and how it works can be found in this overview http://t.co/CURStgm2 #fed #participation" is an invitation from the online editor of the Internet Enquete in January 2012.

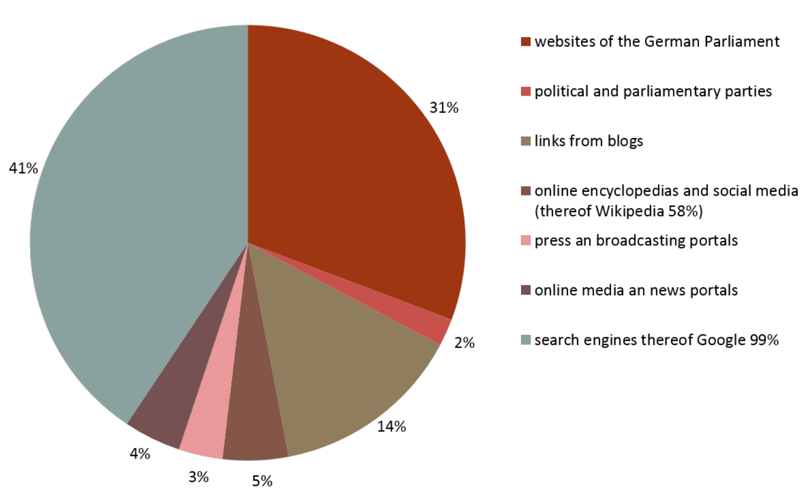


Figure 8: Sources for calling up enquetebeteiligung.de
Author's diagram IZT – Institute for Futures Studies and Technology Assessment

Figure 8 shows which categories of websites the users of the enquetebeteiligung.de website visited before visiting the participation platform.

Many users reached enquetebeteiligung.de via the offering of the German Bundestag. The largest share of hits was through search engines, of which 99% were through Google. It is unknown what the search words of the users were. It is likely that they were made aware of the participation opportunities of the study commission via reports in printed or other conventional media, for example.

The home page of EnqueteBeteiligung.de was given the heading "Knowledge, ideas, expertise for politics". As a task for the platform and the participatory process, the "collection of ideas, proposals and opinions on the future of the digital society" was formulated. In order to actively participate in the platform, interested citizens had to register on the website. A total of 3,305 citizens registered. The participation platform was divided into 13 areas. These correspond to the twelve study commission project groups that had been set up (see also Figure 7) and the additionally established working group on the topic of online participation. In total, the online platform registered 431 suggestions and 2,353 comments.

Once registered on the platform, citizens could first of all suggest topics to be included in the work programme. Further down the line, specific suggestions for recommended courses of action for the study commission could be made. A particular type of suggestion took the form of proposals for amendments or requests for amendments; this took the form of alternative positions on submitted papers. The suggestions could then be discussed, processed and assessed. The suggestions were presented for discussion to the study commission as a proposal from the 18th expert and voted on. The public were therefore consulted, however did not have a vote in the decision-making process (Reichert, Paetsch 2012). The citizens who took an interest placed value on the fact that the study commission documented the results of the online civic participation in their reports and took on suggestions for their interim reports.

Liquid Democracy as operator of the platform Enquetebeteiligung.de had not planned to moderate this participation platform. Based on the factual and constructive contributions to discussions which did not contravene netiquette or law, moderation was not necessary.

Beyond the Internet Enquete:
Online Civic Participation in Bundestag's Parliamentary Work

A structurally similar method for citizens to participate, expanding on the common methods of participation, is offered by "stakeholder panel TA" (www.stakeholderpanel.d), started by IZT, according to an online panel study from 2014 (Opielka et al 2014, Henseling et al 2015) on behalf of TAB. This also ultimately relates to the participation of interested citizens in the work of the German Bundestag as stakeholders of relevant skills. The topic of "online civic participation in parliamentary work" will be the focus of a survey in 2015. Further research will clarify whether the issue is really one of participation in the preparation of decision-making processes or more simply about procedural legitimation as once critically anticipated by Niklas Luhmann (1969). The previous findings allow for a more optimistic picture, above all because the players themselves, i.e. the citizens, are calling for participation and are increasingly helping to shape the required technology.

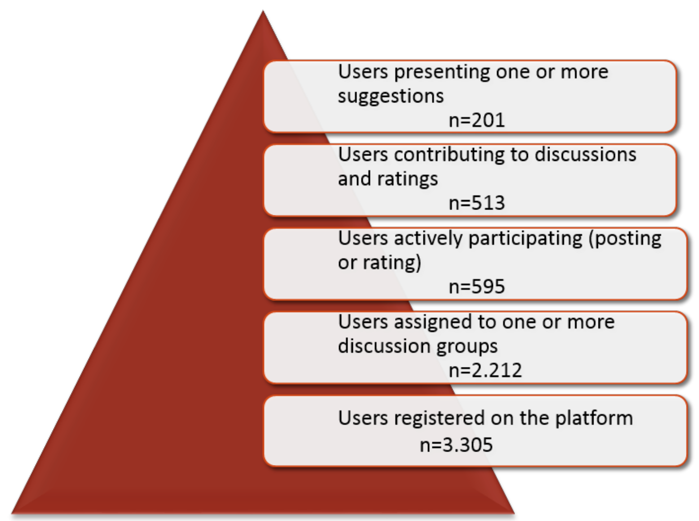


Figure 9: Active users on enquetebeteiligung.de

Author's diagram IZT – Institute for Futures Studies and Technology Assessment

As in other European countries, public electronic petitions serve as an influential mechanism for political participation in Germany. The German Parliament introduced electronic petitions in 2005. Users can post, co-sign and discuss petitions online (Jungherr, Jürgens, 2010; Lindner, Riehm 2011). The Office of Technology Assessment at the German Bundestag (TAB) has conducted technology assessment projects on electronic petitioning. Riehm, Böhle, Lindner (2013; see also Lindner, Riehm 2011) conclude that the introduction of public e-petitions can be viewed as a success story. Statistics such as the increasing number of public electronic petition submissions or registered users of the Bundestag's petitioning portal provide evidence that electronic petitions are generally appealing to a growing number of citizens. A total of 426 online electronic petitions, more than 500,000 co-signatures and more than 1.6 million registered users in 2013 have made electronic petitions the most successful Internet portal of the German Parliament (Deutscher Bundestag, 2015) and can also be considered as a starting point for novel Internet approaches of the German Parliament.

Conclusion

The initiators and operators of www.enquetebeteiligung.de had hoped to have stronger public participation and point out that it did not fulfil their expectations. Against this background, it must be emphasized that more than 3,000 people registered on this platform and that almost 600 of these contributed extensive texts in a time period which was limited with regard to the issue but extensive as far as participatory processes go. The factual and constructive tone, expert knowledge and the willingness to get involved shaped the participatory process. Future deeper analyses of the topic will paint an even more diverse picture of this.

Using the example of the Internet Enquete, the first analyses of the IZT preliminary study result in an overall positive picture of online civic participation in parliamentary work. The platform www.enquetebeteiligung.de functioned reliably and, as a test bed, it set important priorities for the work of the study commission, gave a stimulus for its work and satisfied public expectations of participatory processes.

The final Internet Enquete report maintains that it was not new for parliamentary work "to incorporate external content contributions into the opinion-forming process" (Deutscher Bundestag 2013). However, it is to be assumed that many contributors on www.enquete-beteiligung.de were committed citizens who are not otherwise part of the network of parliamentary work.

It was also clear that user expectations differ in their understanding of the term "online civic participation in parliamentary work": to what degree can citizens truly become involved in consultation or even decision-making processes? Furthermore, pooled experience and specialist expertise is needed to avoid mistakes and public criticism, to meet the requirements and expectations of users with regard to commitments and make sure that promises are kept.

In addition, questions arise concerning user-friendliness, privacy or data security and privacy issues which need to be further investigated and discussed in the future. Examples are: Should the German Bundestag allow registration or login via Twitter or Facebook? Which user data should be collected and stored?

The full-scale study of online civic participation on behalf of the Office of Technology Assessment at the German Bundestag will apply itself to this challenge amongst other things. It will put these questions into a broader picture of the evolution of parliamentary democracy and its subtle processes.

References: Page 421

Approaching Synthetic Biology for Societal Evaluation and Public Dialogue

A Session Summary

Stefanie B. Seitz

Abstract

Among the new and emerging technosciences, synthetic biology (SB) is one of the hottest topics for technology assessment. The aim of SB is to be more than advanced biotechnology, developing biology as a substrate for engineering by adapting concepts developed in the fields of engineering. The visions of SB offer enormous opportunities which are counterbalanced by risks that must still be studied and by conflicts with public norms and values. An early assessment that includes a broad spectrum of expertise (including citizens as experts for everyday life) seems to be a basic requirement for guiding consequent governance action toward a societally preferred development of SB. At the same time, stimulating early public engagement and eliciting a public or political debate are quite demanding. This purpose of this paper is to conclude the eponymous session at the PACITA conference and reflect on the approaches presented by the speakers – Virgil Rerimassie, Britt Wray and Rüdiger Trojok – concerning this challenging task.

Introduction

Synthetic biology (SB) recently emerged at the interfaces between molecular biology, biotechnology, organic chemistry, engineering, informatics, and systems biology. The increase in our knowledge and the recent advances in these fields have increased our ability to design and build robust and predictable biological systems using engineering design principles. Consequently, the aim of SB is to develop biology as a substrate for engineering by adapting concepts developed in the fields of engineering and thus introducing a new quality of scientific development (Benner/Sismour 2005; König et al. 2013).

Beside first applications that are still rather "sophisticated biotechnology" (Fussenegger 2014), SB also produces numerous visions and promises. For example, it is an abundant claim that SB can contribute to the solution of the world's most significant challenges, like sustainable energy supply, fighting disease, or even remediating polluted sites. At the same time, contemporary SB is mainly basic lab research about fundamental questions of life toward understanding the basal components and functions of living organisms (Boldt et al. 2009). But foremost the vision of man-made artificial life and organisms that only serves human needs raises concerns. Is it morally permissible to pursue these aims? Is there a threat to human health or the environment, and what is the societal impact? Almost from the beginning, these questions made SB an object of different kinds of assessments – including technology assessment (TA) (Seitz 2015).

This paper aims to conclude the eponymous session at the PACITA conference and reflect on the approaches presented by the speakers concerning the following questions: How can a societal assessment of SB be successful? What can 'the public' contribute to this assessment of SB and how can it be integrated in the political decision-making process? How can we promote public interest in SB and the public dialog about it?[1]

Towards Political Debate and Societal Assessment of Synthetic Biology

Technology assessment is committed to serve society in not only look forward to the visions promised and benefits intended by technological developments, but also detect and warn against possible side effects (Grunwald 2010). Especially in the field of new and emerging science and technologies (NEST) it aims to start the assessment early and enable R&D governance to lead the development into a societal desirable direction (Nordmann 2011). Thereby, TA ran into a dilemma that has already been described by David Collingridge in 1980: While the steering options for emerging technologies are wide, the forecast of possible risks and unwanted effects is relatively vague and based only on an insufficient knowledgebase. In order to bridge the gap, numerous approaches in Science and Technology Studies (STS) and TA use societal assessments that include the public in the one way or the other (Kolleg/Döring 2012).

This could be also the preferable way for SB. Because, as Margret Engelhard, senior researcher at the European Academy of Technology and Innovation Assessment (EA) in Germany, emphasized, SB cannot be viewed as a monolithic block. It is rather diverse and on the move. While the general subfields are well described, large diversity of the disciplinary backgrounds but also regional/cultural differences of the scientists contribute not only to the structuring of the field but are also framing the individual research agendas to a great extent. This diversity complicates the assessment of state of the art in the field. Moreover it makes societal evaluation of synthetic biology a challenging task and prone to misunderstandings. Therefore, she suggested that instead of directly reviewing the field as a whole, it should be focus on characteristic features of synthetic biology that are relevant for the societal discussion. The prime example here is the enlarged depth of intervention in comparison to biotechnology. Some of these features apply only to parts of synthetic biology, where others might be relevant for synthetic biology as a whole. In the next step,

she proposed, this refined view can be utilized for ethical evaluation, risk assessment, analysis of public perception and legal evaluation because a differentiated discussion on synthetic biology can facilitate and support a problem oriented and sound evaluation of synthetic biology (Engelhard, personal communication).

The goal of many approaches in TA (and STS) is to involve lay people and societal stakeholders in order to gain knowledge for the academic assessment process (e.g., Hennen 2012). Some of them – more or less tacitly – also intend to elicit public debate (e.g., Sturgis 2014). This was – very explicitly – the aim of the Rathenau Institute (RI) in the Netherlands and its active approach toward establishing SB as a topic of public and political debate in order to promote the proper societal embedding of SB. Virgil Rerimassie presented The Meeting of Young Minds[2] (organized by RI in 2011), which represents a youth debate between 'future synthetic biologists and future politicians'. The former were represented by participants of the international Genetically Engineered Machines competition (iGEM) and the latter by political youth organizations (PYOs) linked to Dutch political parties. The RI found seven PYOs – varying from right wing to left wing and from green to Christian – willing to commit to an intensive process aimed at formulating a tentative partisan opinion on SB and defending it among fellow PYOs and iGEM participants. This format was attractive for several reasons. First, little was known about how political parties gauge SB. Thus, the analysis of the debate contributes to our understanding of where potential political sensibilities and concerns may arise. Second, it involved young scientists who are at the beginning of their careers and who were encouraged to think about the ethical and societal aspects of their work in the field. This would be in line with the thinking of different STS and TA approaches (for an overview see Kollek/Döring 2012) as well as of responsible research and innovation (von Schomberg 2013; Stilgoe et al. 2013).

Biohacking and Bioart - The Need for Experimental Communication in Synthetic Biology

Involving the public in the NEST field is challenging and full of traps (Bogner 2012). Due to the fact that there is no self-organized public debate (Seitz 2015), all kinds of "invited participation" (Wynne 2007) around SB has to deal with the challenges (cf. Bogner in this book). Foremost, one has to find answers to the questions of how to interest people for SB and enable them to access the topic without influencing their own framing any more than necessary.

In her presentation, Britt Wray[3] spells out the use and influence of imagination in 'performative sentences' about SB. She asks how a science communicator's role might be refreshed experimental way to qualify and critique such "imaginaries of SB". Thereby, she reveals that in SB the connection of "engineering practice to a plurality of life forms" has created a condition which appears unprecedented (Mackenzie 2013). This seeming lack of precedents ties it to discourses of 'bio-objectification' and what bioartist Oron Catts[4] calls "Neolife". But this assumption seems to be wrong. Britt Wray argues with Bernadette Bensaude-Vincent (2013, citing Austin 1962), who describes visions of SB as 'performative sentences' which are "sentences which do something in the world rather than (just) describing something about it". Thus, she concluded, part of the functional effect of these 'performative sentences' is that they mask the long history of technosciences and brings a kind of cultural amnesia into play, which gets produced through its imaginaries. But according to her, these masked histories of technoscience, 'neolife' and bio-objects can be brought into a more productive relationship with SB discourse than is presently the case. Being a science communicator herself (and currently a PhD candidate in Media, Cognition and Communication at the University of Copenhagen in Denmark), Britt Wray reflects on the role of the science communicator. In a time when the roles of anthropologists, ethicists, sociologists and even artists are being increasingly well documented for their critical contributions to the discourse of interdisciplinary experimentation concerning SB, the role of the science communicator is left to steep in its confined status as "hype maker." She demands the revitalization of the role of science communicator and that 'post-ELSI' research be taken seriously, which declares there is a need for new experiments in knowledge production in SB by scientists, social researchers and their publics that are "pluralist, reflexive, and promote mutual learning" (Rabinow/Bennet 2012, Fitzgerald et al. 2014, Pauwels 2013, p. 225).

In line with this, the role of citizen science is being increasingly discussed. Although the definition of citizen science is rather vague – all kinds of research activity involving citizens as nonprofessional (help) scientists – in the field of SB it got a lot of attention. Here, a small and bottom-up community of citizen scientists gathers to work on a project involving methods from (molecular) biology. Some of them, the DIY biologists, are even organized globally in a clublike structure (e.g., Charisius et al. 2013). In this context the so-called biohackers have gained much attention. 'Hacking' in this case was meant in a positive sense of gaining insight into biology and providing open access to the world of molecular biology. However, analogous to the connotation that exists to (computer) hackers, there is a lot of distrust from official sites and suspicion that this might be the roots and shoots for bioterrorism (cf. Nash 2010). In contrast, the aim of the vast majority of the members of this scene is to democratize life science.

In his presentation "Biohacking as Citizen Scientists and the Global DIYbio Scene - an Introduction: Who Are Biohackers and What Is It About?", Rüdiger Trojok,[5] citizen science activist and currently at TAB, gave an example of the motivations and activities of biohackers. The example of a citizen science activity in this field that he offers is to allow workshop participants a deeper understanding of the antibiotic resistance spread in bacteria – a everyday phenomenon but therefore even more pressing because, as he stated, this problem affects "each and every one of us, globally, that cannot be resolved by e.g. better regulation, but neither by a smart new invention". According to Rüdiger Trojok it takes scientifically literate public "to engage with the problem from a holistic point of view, working in accordance with smart governance as well as innovative and sophisticated technologies". During the talk he presented the latest innovations in the life sciences and their potential to be applied outside traditional laboratory research, e.g., in citizen science

projects. He also addressed the risks and chances, but also the challenges that must be faced in order to realize this urgently needed solution. And finally, he proposed a first approach to defining the requirements for the needed organizational structure and the role of citizen scientists within it, as well as for digital and biological technologies. Nevertheless, the current regulation (especially in Germany) allows very limited biohacking, and the citizen scientists need to plan their activities carefully in order to stay within the requirement of the law (e.g., the German Gene Technology Law).[6] Thus, safety and security issues were central in the discussion in his talk, just as they are in the academic debate (cf. Blazeski 2014).

Conclusion

SB is currently one of the prime examples of NEST. During the session it became clear that the involvement of the public in creating a societal assessment of this technoscience can help to facilitate its development and governance in accordance with societal values and for the benefit of society. Nanotechnology may be taken as a prime model here because it shows the advantages of early assessments that involve the public in diverse formats. In this case, the early onset of accompanying research and the engagement of the public led to a development without broader public conflict, even though public dialogue became a tool for governance (Kaiser et al. 2014), and shaped governance processes toward more responsibility. However, the formats of public engagement are still quite a matter of dispute (see Bogner in this book). But the session showed that each of the approaches presented here reaches different groups: Politically active people as in the case of the 'Meeting of young minds' presented by Virgil Rerimassie; the ordinary citizen who likes to be entertained and enjoy (bio)art like in Britt Wray's example; or rather the more activist one who is engaged with a love for subculture, such as those who come to Rüdiger Trojok's biohacking workshops. Altogether, all of these approaches will make citizens think more about the issues of SB and, therefore, enhance the public debate on it. This is supposed to be a good starting point for the democratic R&D-governances we want.

References: Page 422

“Enabling” Public Participation in a Social Conflict

The Role of Long-Term Planning in Nuclear Waste Governance

Sophie Kuppler and Peter Hocke

Abstract

One challenge for public participation in nuclear waste governance is for political decision makers, the public administration, industry and the interested public to co-design a governance process – a process, which promises to be adequate to meet the challenges occurring over a very long period of time and to keep the debate on the governance process open and alive over time. Long-term planning is a necessary prerequisite for public support for a nuclear disposal project at a specific site. For this purpose, it is key to create suitable institutions and have early planning and institutionalization of participatory processes combined with the flexibility to react to future challenges.

Introduction

The aim of the research project ENTRIA is to compare the advantages and disadvantages of three key options in radioactive waste management and to discuss them in their social, juridical and philosophical contexts.[1] Two of the three options, the maintenance of a free underground repository and an underground repository with retrievability[2] are long-term projects not only with regard to the lifetime of the waste, but also with regard to the planning and management of the facility: Construction will take one to two decades, and operation will go on for at least four decades (considering the German amount of nuclear waste). From a social science point of view, “planning” for such projects means to think about institutions. This refers to control agencies, ministries and also regional participatory platforms. As we will argue in this paper, in addition to these institutions, a hybrid organization will be needed which will be prepared to act as a steward in the mid- to long-term. Our hypothesis is that, at least for Germany, consistent and robust long-term planning in which institutional settings including public participation are prepared is a central prerequisite for the public’s willingness to participate in a disposal program.

Long-Term Stewardship and Nuclear Waste Governance

One concept dealing with the future management of nuclear sites is the long-term stewardship program implemented by the United States Department of Energy. It refers to the institutionalization and consolidation of the management of military and other nuclear sites and shows that it is a difficult task to define what measures will need to be taken in the future and what costs are to be expected (US Department of Energy 2001). It does not deal with questions of institutional setup.

To think about the institutional requirements and public participation for long-term tasks, it is helpful to take a look at the governance literature. In governance arrangements, problem solving is not carried out by the state alone, but in a "network of actors" (Mayntz 2009, Grande 2012). This means that not only the authorities, the government and established stakeholders from industry are involved in decision making, but also advocatory interest groups, local initiatives and associations from civil society. Particularly in nuclear waste governance, the state still plays a strong role as it sets the rules according to which other actors are included in the network and takes ultimate responsibility for the waste (Torfing 2006).

Since the efficiency of the decision taken cannot be evaluated (output-legitimacy) (Berkhout 1991), the quality of the decision-making process gains in importance (input legitimacy).[3] Thus, if social control over a repository is deemed important over a long time span, a robust decision-making structure has to be available as it facilitates robust structures of assessment and action. It would need to be flexible enough to react to changes in the social and natural environment and, at the same time, fixed so that responsibilities are clear. The role of public participation in this also needs to be clear (e.g. Langer/Oppermann 2012, Mauch 2014).

Tasks in Long-Term Stewardship

The tasks to be fulfilled in long-term governance and the time span over which they will need to be fulfilled differ depending on the disposal option chosen and the respective concept. For both types of deep geological repositories, strong controls will be needed until closure.

- Above-ground challenges in every option:
  - » Maintenance of the building.
  - » Limiting access to the site and its infrastructure and technology.
  - » Maintaining knowledge for handling the waste and on the functioning of the building and its technology.
  - » Robust decisions on marking and creating memory.
- Additional challenges for underground disposal with retrievability:
  - » Maintaining knowledge regarding monitoring facilities and monitoring data.
  - » Maintenance of the technology needed to retrieve the waste.
  - » Maintaining knowledge and technology for finally closing the repository.

- Additional challenges for underground disposal without retrievability:
  - » Limited possibilities to reverse decisions mean there is limited time for monitoring and correction and, thus, high demands on regulating and controlling institutions.

The same kind of task can pose very different challenges to long-term stewardship depending on the point of time at which it occurs. In the following we will illustrate this using a dense description of an event in which stewardship would be needed at two different points in time. The event we use as an illustrative case is if, in a deep geological repository with the option for retrievability, some monitoring data develop in a different way than was anticipated on the basis of the reference models guiding the monitoring concept. The institution responsible for decision making will have to decide on how to proceed.

In our first example we assume that this situation occurs during the operation phase, in which the repository is still open. At this point of time the technological equipment for handling the waste will still be underground, trained staff will be used to working with the different kinds of technology and to handling the waste. Getting further information on the development of the repository will be comparatively easy. The waste problem will still be 'present' on the political agenda and resources will be allocated. In this situation, the institution responsible for stewardship will have a relatively large degree of freedom regarding its decision as it is very likely that it will have the knowledge, man power, technology and resources it needs.

In our second example this occurs during post-closure. Under these circumstances, the situation will be quite different. The repository will have been closed, which means that the technological task of getting to and handling the waste is much more difficult. Further, depending on the amount of time that has elapsed since closure, the staff at hand might be well trained (if at all), but may not have any experience with handling the waste. Regarding the state of the repository, it could be difficult to obtain adequate und sufficient data for further analysis. Resources could also be a problem as the waste will probably not be on the political agenda any longer and the will to allocate additional resources will be limited. In such a situation, the degree of freedom will be much smaller and the consequences of a decision to retrieve the waste much bigger.

In both cases, the central question is who should decide. Can it be science alone? Or is it or should it also be a political question? If yes, who should be involved? How should the public take part in decision making? How can we guarantee transparency? Our hypothesis is that the answer differs depending on the point of time due to the different challenges that prevail.

Challenges and Institutional Requirements in Long-Term Stewardship

Over the whole repository lifetime, certain actors and institutions will be present. Those are an implementer of the repository, a national authority which is responsible for control and regional participating institutions. Our hypothesis is that in the long-term this arrangement has to be supplemented by a stewardship institution.

The stewardship institution's main task is to be responsible for the monitoring, the robustness of generated monitoring data and the technical infrastructure, which is the precondition for measuring and interpreting data. The institution could for example be an institute integrated in a technical university with basic research and applied sciences for radioactive waste management and the training of PhDs and post-docs. Their research field has to be oriented on the state of the art of geological monitoring and data interpretation. In addition it would have to act as an emergency unit.

It cannot be assumed that the current academic structures and public institutions will be able to fulfil all the required tasks due to the problem's doubly complex nature (Kuppler 2012, Dryzek 1996). In addition to the technical tasks, the stewardship organization will have to be able to enter into a dialogue with civil society and react to a changing political environment. Reflecting the state of the art in nuclear waste science, the stewardship institution will have to have access to the infrastructure and knowledge to carry out practical tasks at the repository site with short notice. In conclusion our hypothesis is that the stewardship organization will have to have the characteristics of a "hybrid organization", which is embedded and has to react to certain structural elements.

These structural elements will all develop over time:

- The attention of official politics and governmental organisations decreases. The reason is that radioactive waste management moves from being a highly-politicized problem to a classical problem of waste management and control.
- The stewardship institution needs to be prepared during the operation phase. In the phase of closure and post-closure its importance is generally high and constantly increasing.
- At least the residents at the local site of the repository need to be involved in stewardship. In the beginning their interests will possibly be represented by experts they trust. In closure and post-closure they will probably be involved more directly.
- In an ambitious stewardship model a robust system of checks and balances[4] plays a central role. We expect decision making to become more complex for the stewardship organization, but this is also true for the interactive process between all the involved actors. The importance of functioning checks and balances increases as political and societal attention decreases over time.

In addition to the institutional requirements described above and the hypothetical developments of the long-term governance arrangements, further requirements for a functioning governance arrangement can be described. First, regarding the knowledge needed for decision making, the responsible public institutions will need to have scientific expertise at hand. The source of information should not only be the stewardship organization. Rather, it would be favourable to have a diverse, functioning research community which is able to provide different kinds of knowledge ranging from the basic to the applied and which stands in a critical dialogue with dissenting scientific positions. Second, the question needs to be answered how the public and stakeholders will be involved.

Conclusion

Flexibility to react to the future is one of the major challenges in radioactive waste management, including in Germany. First, there needs to be flexibility in order to be able to react to natural underground processes that occur due to the depositing of highly radioactive waste in geological formations. Second, flexibility is needed in order to guarantee transparency and professionalism. Transparency is necessary as the neighbours of nuclear underground repositories want to know how and by whom decisions are taken and about the risk and inherent safety of such a nuclear installation. Professionalism is necessary as underground repositories are advanced technologies of waste management. The question is whether this will happen in a professional way and under conditions of substantial participation.

Which institution will care for the repository over decades or even longer periods? Long-term aspects of ionizing radiation are now being discussed, but also have to be considered by competent institutions which are prepared for long-term monitoring, data interpretation and action. For this reason, society is asking for solid planning of the operation phase of an underground repository, but also of the closure and the post-closure phases. This means that there has to be a system of checks and balances for monitoring and data interpretation for several decades or even for centuries. This is one central prerequisite for a widely supported solution to the nuclear waste problem in Germany and possibly also elsewhere. Long-term planning is a possible way for the current responsible institutions to create hope that the problem of highly radioactive waste management is managed in a solid and intellectually reflected manner. Substantive preparation of the needed institutions, which do not exist yet, is necessary. If local civil society at potential repository sites is not integrated, an important chance will be lost to gain support or at least some kind of tolerance for the ongoing planning for a multigenerational project such as underground or long-term surface disposal.

References: Page 423

EXPERIENCES WITH EARLY ENGAGEMENT ACTIVITIES

Articles from the PACITA 2015 Conference Sessions:

(04) Experiences with Early Engagement Activities – The Problems of Pro-active Public Engagement

From Invited Participation to Blue Sky Engagement

Alexander Bogner

Abstract

Currently, with the promotion of responsible research and innovation (RRI) as a guiding vision in science and technology policy, the trend towards public engagement is increasing. In order to influence new and emerging science and technology (NEST) effectively, engagement exercises often set in at an early point in innovation. However, moving public engagement 'upstream' sometimes leads to unexpected side effects: The successful involvement of citizen results in a discourse structured by well-known experts' standpoints and, therefore, becoming increasingly narrowed. To realise the hoped-for gains in rationality associated with public engagement, strategies are needed to leave the usual framings and perspectives behind and to vitalise public deliberation. What we need, in other words, is a kind of 'blue sky engagement'.

The Continuing Trend Towards Public Engagement

When the positivist ideas of a neutral science and of objective expertise came under pressure, several actors in the field of technology assessment (TA) started promoting the concept of engaging the public in innovation and assessment procedures. This 'participatory turn' in TA can be traced back to the 1980s, during which the 1970s' expert model of TA, which aimed at providing policy options based on neutral, scientific knowledge, was supplemented and partly replaced (Grunwald 2009).

Ever since, TA has tried to give previously uninvolved societal actors a voice in the development or assessment of technology. This implied taking alternative knowledge and worldviews into account, which had been marginalised in the dominant expert discourse (Fischer 2000). Meanwhile, this turn has resulted in the development of a new branch of TA – called participatory TA – that organises public dialogues, citizen meetings, and many other events aiming at giving people a say in technology issues.

The trend towards public engagement has increased with the new buzzword of responsible research and innovation (RRI) promoted by the European Commission (EC). From the EC's perspective, shaping innovation responsibly definitely does not mean to shape innovation by introducing regulation ex post facto, i.e., after having recognised unwanted side effects; rather, it means to shape innovation proactively by involving people who are potentially affected (von Schomberg 2013). This is to ensure that innovation meets peoples' needs and to determine whether controversies similar to those over nuclear energy or GMOs might evolve. Obviously, the RRI approach puts special emphasis on public and stakeholder involvement at an early stage of an innovation.

Upstream Engagement with Synthetic Biology

The idea of involving people who are potentially affected or concerned as early as possible originally became influential with the rise of nanotechnology. From 2000 on, a series of events on nanotechnology with public involvement took place in several countries (Kurath/Gisler 2009). The trend towards 'upstream engagement' was not least inspired by the interpretation of new technologies as technosciences. The latter term implies that technology development does not follow basic research in a linear way, but rather that principles of feasibility and marketability influence basic research itself. Fundamental decisions on applications are made during an early stage of research, possibly deciding the fate of a particular technology for good (Nordmann 2011).

Today, TA is still engaged with nanotechnology, but over the past few years TA has turned its attention more towards new technosciences such as synthetic biology and neuro-enhancement. Consequently, TA experts have stimulated and organised a series of public dialogue events. In the following I will focus on examples of participatory events explicitly dealing with the new interdisciplinary research field of synthetic biology:

1. Science Cafes: Between 2009 and 2011, science cafes on synthetic biology were held in five cities across Canada (Navid/Einsiedel 2012). The number of participants ranged from 25 to 150. From the organisers' view, the science café was primarily a knowledge-translation tool following the public understanding of science paradigm. After experts had introduced the issue, the discussion was mainly held in a question-and-answer format. For laypeople involved, learning more about synthetic biology was the primary motivator to participate.

2. Public dialogue: In the UK, two ambitious participation experiments took place in 2009. The Biotechnology and Biological Sciences Research Council (BBSRC) initiated the 'Synthetic Biology Dialogue' to identify public concerns around synthetic biology. In three workshops, 160 people were brought into dialogue. Another example was the "Public Dialogue on Synthetic Biology", initiated by the Royal Academy of Engineering. During a half-day meeting, 16 citizens (of different gender, age, social grade and ethnicity) discussed the then current level of awareness of synthetic biology (which was low).[1]

3. Public and stakeholder engagement: Currently, a consortium of TA and science communication institutions led by the Karlsruhe Institute of Technology carry out an EU project called SYNENERGENE (2013-2017), funded under FP7.[2] Following the RRI approach, the project aims to bring a variety of societal actors into dialogue and to stimulate the publics' interest in synthetic biology by organising participatory events in many European member states. Fortunately, the project does not limit itself to organising events but devotes resources to an in-depth analysis. Gene Rowe carries out an evaluation of all events based on standardised methods, and the author is assigned to conduct an analysis of selected events, methodologically drawing upon participatory observation and additional interviews.

The Challenges Posed by Upstream Engagement

With a view to technology issues, the idea of public engagement has been launched starting in the 1980s. Experts from TA and STS developed various procedures intended to effectively include persons previously not involved in assessment procedures (see Rowe & Frewer 2005). Participatory procedures, as theorists like Callon et al. (2011) argued, could help to politicise technology issues that had been restricted exclusively to closed circles. Additionally, STS scholars often highlighted the cognitive advantage of lay knowledge correcting or supplementing expert rationality (Collins & Evans 2007). In a similar vein, Stirling (2008) considered new questions and options as were developed in participatory procedures to be particularly appropriate for rendering a debate more comprehensive. However, in order to influence technology development effectively, participation has to set in at an early point in innovation. This assumption triggered the idea of moving public engagement activities upstream (Wilsdon/Willis 2004).

However, moving public engagement to an early phase of science and technology development entails some problems. Upstream engagement sets in at a point in time when there is no cause for public controversies. In addition, there are no concrete applications that could trigger citizens' concerns or stimulate the publics' imagination. Technosciences such as synthetic biology are poorly linked to the everyday world of lay people; consequently, the public tend to be little interested. Several engagement exercises over recent years have shown that citizens need to be actively interested and motivated to participate (Bogner 2012). Public engagement events often are organised by experts from the field of STS or TA in the form of third party funded projects (by national research councils or by the European Commission). As a result, a participation industry has emerged, i.e. a network of actors and institutions with special expertise in initiating, organising and carrying out such events. Upstream engagement, in other words, takes the form of what STS scholars have called 'invited participation' (Wynne 2007).

Invited and Uninvited Participation

Invited participation is a form of controlled activity within a defined set of boundaries. First of all, invited participation is restricted with regard to the number of participants (to be selected by the organiser). Second, invited participation is restricted with regard to time. The respective project is an episode in a potential continuum of further similar events. Third, the organisers provide a particular framing of the issue. This is essential because laypeople are not familiar with the technoscience at stake; in some cases they may not even have heard about it.

In contrast, uninvited participation is self-organised (for example by patient groups, see Wehling 2014) and/or promoted by protest movements and non-governmental organisations (NGOs). In principle, the number of participants is unlimited; the only requirement is equal-mindedness. Uninvited participation is a priori temporally unlimited; it exists until the problem is solved or there is no new issue at hand that would mobilise people. This kind of participation is directed at influencing politics and exacerbating conflicts. In other words, there is no need to invite people, because they organise themselves; in the controversies over nuclear energy or agri-biotechnology, the protest even took on militant forms (Rucht 2003).

Today, with regard to emerging technologies, info trucks instead of police cars enter the scene. In the light of public dialogue and of initiatives such as the Nano Truck, a rolling communication centre sponsored by the German Ministry of Education and Research,[3] one is tempted to say: information is literally driven into the public to make people reflect on the chances and risks of nanotechnology and to intensify the public debate.

Even though this might be a distortion of public engagement, we have to admit that invited participation turns out to be a kind of technology itself, namely a rational process following a clear trajectory: organisers set up a procedural plan, define aims, calculate costs and anticipate potential hurdles and problems to be avoided and solved. In sum, participation turns out to be a well-organised, rational process in order to arrive at predetermined aims (such as citizen statements or stakeholder recommendations). In contrast, uninvited participation mostly aims at enforcing certain interests, exacerbating conflicts and making politics. This kind of participation is often characterised by collective consternation and emotions.

With a view to legitimacy, one may ask whether uninvited participation may soon be considered an irrational or even illegitimate form of engagement, while invited participation becomes the normal mode of engaging with technoscience.

Towards Blue Sky Engagement

Several STS studies have shown that, for several reasons, invited participation is incapable of opening up the debate as desired. For example, alternative rationalities are marginalized because lay people have to argue along the lines of ‘sound science’ (Bora 2010). The power of experts and their scientific narratives leaves few options for citizens to autonomously shape the agenda and the outcome (Irwin 2001). In the end, narrowly framed interaction processes do not allow science and technology to be politicised (Delgado et al. 2011; Kleinman et al. 2011).

This is somewhat paradoxical. The successful involvement of laypeople results in mainstreaming the discourse. To rely on the typical ethical, legal and social aspects or on the arguments from past technology debates restricts the actual debate to well-known perspectives and to structure it along the issues already debated by previous expert panels on other technologies (Bogner 2012, Bora 2010).

The latter explicitly holds true for contemporary engagement exercises in the field of synthetic biology. As our experiences with public dialogue events in the context of the EU project SYNENERGENE show, participants would often refer to existing controversies on other technologies, rather than engaging themselves in controversial discussions on synthetic biology itself, e.g. by demanding stricter regulation, raising ethical concerns or emphasising risk issues. In most cases, frames and arguments were referred to rather than explicitly put forward. For many participants, advocating a consideration of risks or ethical concerns does not seem to be an appropriate way of dealing with science and technology issues anymore (Bogner/Torgersen 2014).

Strategies are therefore needed to leave the trodden path of academic discussion, to bring participants’ own experiences to bear, to arrive at personal statements, in short to hold a lively debate. However, and especially for lay people, the issue needs to be made easier to handle in order to elicit engagement. If an abstract novel technology could somehow be linked to people’s everyday lives participants would be enticed to engage and to take up stakes, to come up with an opinion and to defend it. Therefore, a context needs to be found that shows relevance for peoples’ everyday lives and allows normative issues from their lifeworld (‘lebenswelt’) to be incorporated into the debate. In other words, ‘invited participation’ needs to politicise technology issues.

This means that public dialogue events have to be multifaceted and controversial. Normative issues are often especially appropriate to make scientific problems relevant to laypeople and stakeholders; they link scientific problems to the real world, provoking contradiction and disagreement. Participants are enticed to engage and to take up stakes, to come up with an opinion and to defend it – always provided a vague and abstract technoscience can somehow be linked to basic problems posing the issue at stake into a wider context.

To give an example, in October 2014, along with a film festival organised by Biofiction in Vienna, a series of public dialogue events on synthetic biology took place.[4] With a view to the biohacker movement (see Delfanti 2013), the question came up whether citizen science is to be considered a manifestation of democratisation or a folly.[5] This led to a lively and engaged discussion focusing on broader issues rather than on technicalities or the risks of synthetic biology – aspects experts typically would cover.

Only if politicised, may questions of science and technology attain a level of interest where the added value of participation materializes: the demonstration of diversity, breadth and dissent that may lead to new aspects and new options. From this point of view, it might be better to open up the perspective and to frame the debate in a broader way without losing a clear focus. With a view to emerging technologies, TA might set up engagement experiments that allow participants to discuss more general questions such as: What is your notion of a good life? What kind of research do we want? And who should participate in the process of knowledge production?

In other words: we should aim at blue sky engagement.

References : Page 424

The Interface between the Public and Science and Technology

Jürgen Hampel and Nicole Kronberger

Abstract

The way technological innovation is discussed in the scientific arena has changed substantially in the last decades, and this change has had repercussions on the way we discuss the interaction between science, technology, and society, which has shifted from a perspective of technological determinism and the deficit model to the modern understanding of technological development as a social process. In this paper we discuss different concepts for closing the gap between science, technology, and society, and discuss major methodological problems related to public engagement. As we will demonstrate, the concept of public engagement is far from being homogeneous. It is used to refer to diverging and sometimes even conflicting goals.

The Sociological Understanding of Technological Innovation and Its Implications for the Interaction between Technology and Society

In his fundamental book on social change, the American sociologist William Ogburn (1922) understood technology as an extrasocial force following its own logic. He perceived the relationship between technological innovation and society to be one directional: While the path of technological development is not dependent on society, technological innovation is forcing societies to adapt to it. The term "cultural lag" implies that the development of technology is faster than the abilities of societies to adapt to the innovation. The challenge for societies according to this understanding of technological innovation is obvious, namely the closure of the cultural lag. This is the core argument of the so-called technological determinism paradigm. From that theoretical perspective, the idea of informing the public seems to be appropriate.

Concepts based on the implications of the deterministic model of technological development dominated the discussion of the interaction between technology and society. From the 1960s onwards a view emerged that identified a lack of public knowledge as the core problem (the scientific literacy paradigm). Research in this tradition focused on the ways in which everyday people 'misunderstand' science, and the solution to the problem was seen in educating the public. Increasingly this view was complemented by the idea that lay people are not positive enough about science. Thus, since the mid 1980s both lay people's knowledge and attitudes were addressed by the label of public understanding of science. A central assumption in this paradigm was that better knowledge about science would increase people's enthusiasm about it. Interventions addressing the public included both the element of science education and that of 'selling' science (Bauer/Allum/Miller 2007).

Fundamental Concepts of Technological Innovation	Concepts of the interaction with the Public
Technological determinism	• Cultural lag • Public understanding of science • Deficit model
Technological innovation as a societal process	• Participatory technology assessment • Public engagement • Responsible research and innovation (RRI)

Table 5: Concepts of Technological Innovation and Implications for the Interaction with the Public

While the concept of technological determinism still dominated the academic discourse in the 1960s (e.g., Schelsky 1965), it lost its importance when the process of technological innovation became a major issue for the then new subdiscipline of the sociology of technology (for an overview see Weyer 2008). Already in 1968, Jürgen Habermas published his seminal essay on "technology and science as ideology", arguing that technological innovation is determined by societal interests. Since then, our understanding of technological development has changed substantially. Technology is no longer seen as a force outside of society but as socially constructed. Theoretical concepts like the "social construction of technology" or modern network concepts indicate that technology is the outcome of a social process which is shaped by different actors, and this means shaped by some actors more than by others. As a consequence, questions concerning the legitimacy of these decisions appeared on the agenda.

Diversity of Public Engagement

In parallel to the development of our understanding of technological innovation, a major change in the interpretation of the often troubled relationship between science and society occurred in the 1990s when criticisms of the 'deficit model' of the public (e.g., Wynne 1992) were voiced. Rather than blaming the public for not being literate or positive enough about science, attention shifted to the (potentially problematic) ways experts deal with technoscientific issues. In what Bauer and colleagues (2007) call the science and society paradigm, the problem increasingly was located in a lack of public trust.

In response to this diagnosis, new forms of public participation and engagement were called for. In 1986 the Danish Board of Technology proposed a new form for discussing technological innovation from a societal perspective in order to inform political decisions,

which they referred to as the concept of "consensus conferences", in which deliberation and decision were linked. The Danish Model was adopted and copied in numerous countries, both in Europe and in other continents (Einsiedel 2001) but with one remarkable difference. A review of participatory activities in Europe (Klüver et al. 2000) showed that most of these activities lacked the link to decision making. They were mostly set up as research projects by academic institutions. In consequence, participation was transformed into deliberation without a clear differentiation between these concepts, and the phrase public participation has been increasingly replaced by the new concept of public engagement. The implicit assumption is that upstream public engagement will prevent public resistance (Joly/Kaufmann 2008). Upstream engagement is even linked with promoting the acceptance of new technologies (Wynne 2006).

Rowe and Frewer (2005) tried to bring clarity into the discussion of what public engagement exactly means and distinguished three key concepts that are hidden under the general concept of engagment:

1. Public communication: information is conveyed from the sponsors of the initiative to the public (one-way).
2. Public Consultation: information is conveyed from members of the public to the sponsors of the initiative, following a process initiated by the sponsor (public consultation on public opinion).
3. Public Participation: information is exchanged between members of the public and the sponsors. There is some degree of dialogue. The act of dialogue serves to transform opinions in the members of both parties (sponsors and public participants).

None of the three types refers to participation as a binding contribution to political decision making. Focusing on engagement and deliberation instead of participation, the process itself seems to become a goal in itself. Studies to evaluate such events focus on that perspective and look predominantly at internal procedural aspects (i.e., Goldschmidt et al. 2012).

Recently the new concept of responsible research and innovation (RRI) appeared on the agenda. RRI is, following the definition proposed by René von Schomberg "a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process (in order to allow a proper embedding of scientific and technological advances in our societies)" (von Schomberg 2011: 50). In this understanding, RRI seems to be oriented at the innovation process itself. In its core definition, RRI may be interpreted as a continuation or even improvement of participation, to involve the public in decision-making processes. RRI is not limited to the avoidance of outcomes which are negatively evaluated by the public, but demands a broadening of the set of societal actors involved in the discussion of the goals for which technology should be developed. While public participation is on any expected or anticipated resistance, RRI has a more general approach irrespective of existing social resistance to the development under consideration. RRI would then be on the establishment of working relations between societal actors in order to stimulate technological innovation processes. In order to do so, the establishment of stable relations between different actors would be a requirement.

When taken up by the European Commission, RRI was combined with the political goal of the European Union to become the leading place for innovation in the world. Maire Geoghegan-Quinn, the former EU commissioner for science and technology, combines RRI with the creation of a smarter greener economy where prosperity will come from research and innovation. "Researchers, policy makers, business people, innovators, and most of all, the general public, have difficult choices to make as regards how science and technology can help tackle our different societal challenges… we can only find the right answers by involving as many stakeholders as possible in the research and innovation process." She states that "research and innovation must respond to the needs and ambitions of society, reflect its values and be responsible…" (Geoghegan-Quinn 2012, cited after Owen et al. 2012: 753).

In its practical application, RRI, which is more a general goal than a precisely defined activity, runs the risk of being employed to reformulate traditional concepts like the deficit model in order to increase public enthusiasm for technological innovation. It seems to be sufficient to bring together different types of actors, such as people from science, industry, different stakeholder groups, and the public. Looking at projects funded on the basis of RRI, it seems that RRI is implemented more as a communication tool with stand-alone mutual learning experiences. In this understanding, RRI sets up a dialogue with stakeholders. A systematic link between process and decision does not exist (not even in the form of a scientific analysis of the public's view on technical developments).

Major Problems of Public Engagement

In addition to a lack of clearly defined conceptualizations of the interaction between technology and the public, the practice of public engagement itself is leading to a number of problems that have to be addressed:

1. ***The timing and inclusiveness of participation***: Concepts like upstream engagement and RRI assume that there is a general willingness of people to participate in any discourse on new technologies. The theoretical fundament of both approaches is Habermas' ideal of deliberative democracy where decisions are the result of deliberation by all citizens and where everyone is eager to participate in such a discourse. In this view, it is important to involve different groups of the public early in the process, that is, before important decisions are made and the process can still be adapted. If societal dialogue comes too late, however, it might take place after closure processes in the development of the new technologies. As the Collingridge dilemma (Collingridge 1982) highlights, however, in an early phase of technological development our knowledge about a technology and its consequences may be so limited that a societal dialogue is difficult because of the vagueness of the topic. If technology-related issues

are not salient (yet) and public awareness is low, this may constitute a challenge for those organizing dialogues. Similarly, the willingness of the general public to participate in dialogue processes should not be taken as a given. Deliberative events organized in the framework of research projects, for example, often involve selected groups of volunteers and experimentation with "mini-publics" (Goodin 2008). That such participation is not welcomed by everyone may also be an issue when we look at stakeholder participation. Stakeholder participation requires active stakeholders. There are enormous differences, however, with regard to stakeholder activities on different issues. There are issues where it is difficult to find stakeholders who can be engaged.

2. ***What exactly should (and does) happen during and after involvement***: While upstream engagement and RRI are more or less uncontested as concepts, there is considerable ambiguity in the understanding and the methodology of these concepts. It seems that the aims of engaging stakeholders and the more general public range from influencing developments in technology policy, to the observation of processes in the formation of public opinion and in "harvesting" opinions, to deliberative activities as a goal in and of themselves. While there are many reports being written, the actual influence on technology-related policies seems rare. Recent efforts to focus on children and young people or trends toward "gamification" do not seem to aim at feeding societal concerns back into processes of technology development. Rather, they seem to stress factors such as being educated.

3. ***Who takes the initiative for involvement (bottom up or top down approach)***: The problem of participation in deliberative processes is also related to the different forms in which participatory projects are organized. The organizing institution may be a public body involved in regulatory decision-making processes, like the former Danish Board of Technology, but in recent years many participatory projects are projects based on research funds, conducted by academic institutions. Even if they perform the same activities, there are huge differences with regard to the degree in which engagement activities are designed to affect decision-making processes. Some authors criticize that participation has more and more become a self-indulgent activity (e.g., Bogner 2010).

Conclusion

We can see that we are far from reaching a consensus on what public engagement or public participation means. Upstream engagement varies from organizing of societal dialogues with decision makers over activities, to providing information to decision makers, to activities to increase support for new technologies. Most of the forms of public engagement developed in the last 50 to 60 years still exist, even when the terminology has been modernized. The problem may be that PTA and RRI may therefore be transformed into something like single activities with no additional goals and no lasting impact. One may wonder whether the older idea of science literacy and educating the public (with the hope of creating more techno-enthusiastic attitudes) will reappear through the backdoor.

To address the problems of public engagement, it is of crucial importance for us to define the goals of engagement more precisely. When engagement activities are not motivated by decision-making processes, other efforts may provide better solutions. Informing decision makers about the views of the public can also be addressed, maybe even better, by employing the methodology of the social sciences.

References: Page 425

Participatory Foresight

Experiences with a Qualitative Demand-Side Approach

Niklas Gudowsky, Ulrike Bechtold, Leo Capari and Mahshid Sotoudeh

Abstract

In this contribution, we provide methodological insights and lessons learned from experiences with a new method for engaging the public in forward-looking policy advice for framework conditions of research and development: CIVISTI – Citizen Visions on Science, Technology and Innovation. By asking citizens what the future should look like and then distilling recommendations for today's and tomorrow's decisions (and hence potentially also technology design), a setting for early upstream engagement is provided that evades the Collingridge dilemma: citizens do not need a profound understanding or representation of a certain technology to express which needs it should fulfil. Our analysis grounds on experiences made during three applications of the method within different spatial scales and political levels – European, national and regional – as well as on different topics.

Introduction

Results of futures studies are often controversial, divergent or even contradictory, and thus become contested (Grunwald 2014). As technological change is rapid, expert anticipation beyond short-term prediction is highly arbitrary. There is a need for broadening the (political) debate on socio-technological development since many actors within the current debate focus on expressing the promise of multiple added values – economic and social – of technological progress. Such a socio-technical imaginary may prescribe a future that seems attainable to the ones involved in the visioning process (Jasanoff/Kim 2009). However, other possible futures may then become less likely and shaping them could become more difficult.

Here, engaging citizens as well as involving experts and stakeholders may serve for combining different types of knowledge to build desirable, socially robust futures. Within this setting, it may be alleviating to ask how the future should look like, instead of merely developing deterministic models to predict how the future will be. Such desirable prospects may then serve as stimulant for the contemporary discourse on governing innovations actively.

The transdisciplinary, qualitative foresight method CIVISTI[1] is a demand-side approach that identifies societal demands for future developments. By asking citizens what the future should look like and then distilling recommendations for today's and tomorrow's decisions (and hence potentially also technology design), a setting for early upstream engagement is provided that somewhat evades the Collingridge dilemma in the first place: citizens do not need a profound understanding or representation of a certain technology to express which needs it should fulfil. It is the responsibility of decision makers to take up that information and act accordingly.

In this contribution, we want to give methodological insights and lessons learned from experiences with a new method for engaging the public in forward-looking policy advice for framework conditions of research and development. Our analysis grounds on experiences made during three applications of the method within different spatial scales and political levels – European, national and regional – as well as on different topics.

CIVISTI – the Method

Within the method, citizens develop visions regarding a desirable future in 30-40 years on the basis of their individual background and creativity. Based on the values, hopes and fears incorporated in these visions, multidisciplinary teams of experts and stakeholders formulate recommendations for different addressees and on different time scales (i.e. R&D policy, technology developers, city planners or administrators). These results are then presented to all participants of the process for validation and prioritization to ensure internal legitimacy and loyalty to the initial ten visions.

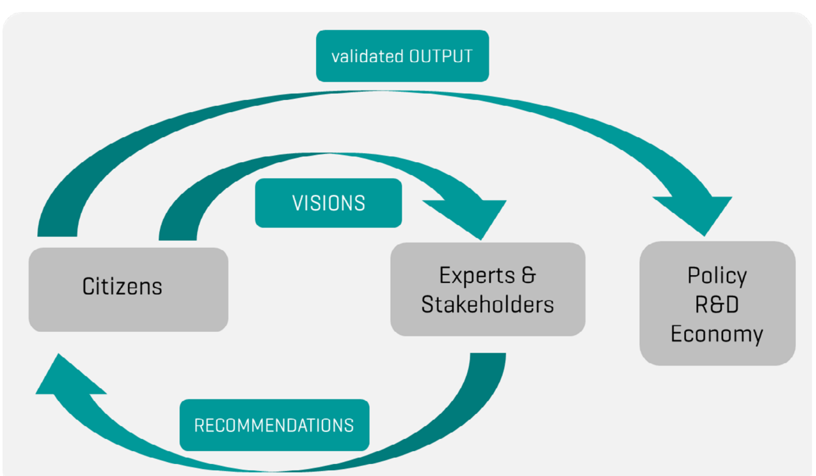


Figure 10: Overview of the CIVISTI method

Case Studies

The method was developed during an EU project (civisti.org, Gudowsky et al. 2012) and tested in seven countries, aiming at providing advice on new, emerging topics for the EU R&D policy, namely Horizon 2020. Later, the method was adapted and applied in a regional context, namely the city of Vienna, Austria, to address the specific topics "autonomous living of older adults" and "ambient assisted living" (CIVISTI-AAL, leben2050.at, Gudowsky et al. 2014, Gudowsky/Sotoudeh 2015). Within the scope of RIO+20, the Institute of Technoloy Assessment conducted a small CIVISTI study with high-school students in 2012. It won a creativity prize, awarded by the Austrian Federal Ministry of Science and Research. Currently, the method is also applied to generate advice for framing the long-term research programme of the Austrian Agency for Health and Food Safety (2013-2016). 'Future Foods 4 Men & Women' aims at looking at new and emerging topics concerning food safety and a healthy diet from a gender perspective and engages citizens across four regions in Austria (www.ages.at/ages/futurefoods/).

Project name	Duration	Funding	Link
CitizenVisions on Science, Technology and Innovation (CIVISTI)	2008-2011	EU FP7	www.civisti.org
CIVIISION	2012	Rio+20 initiative, Federal Ministry of Science and Research (BMWF)	http://oe1.orf.at/programm/308812
CIVISTI-AAL: Leben 2050 – Autonomous Living of Older Adults	2013-2014	City of Vienna, Austria (ZIT)	www.leben2050.at
Future Foods 4 Men & Women	2013-2016	Austrian Ministry for Transport, Innovation and Technology (BMVIT), Austrian Research Promotion Agency (FFG), Austrian Agency for Health and Food Safety (AGES)	http://www.ages.at/ages/futurefoods/

Table 6: Case studies using and developing the CIVISTI method

Variations of Validated Output

The outcome of the first CIVISTI projects were two prioritised top ten lists of recommendations. To improve the communication of results and impact, the CIVISTI-AAL case study introduced several methodological novelties to the CIVISTI method: a steering committee consisting of business and city officials as well as scientists, ensuring that results reach appropriate channels; a new communication tool for the improvement of results as a scenario phase to combine citizens' visions with experts' recommendations (newsletter from the future) and an online voting phase on the final results to add the opinion of the general public. Looking back from the year 2050, the fictional newsletter "Leben2050" describes how ideas identified in the citizens' visions may have been implemented by means of the recommendations the experts and stakeholders gave.

Within the ‘Future Foods‘ case study, a new interdisciplinary work phase was integrated, using visions and recommendations to build scenarios that facilitate the communication of results to citizens and decision-makers at a later stage. Three scenarios describe the context of development in 2030-2050 and focus on gender perspectives considering the impact of the context on the lives of two protagonists (Emma, Emil).

Case-study / Process steps	CIVISTI	CIVISTI-AAL	Future Foods
Citizens Visions	Seven countries: approx. 160 citizens produce 69 visions	One city: 50 citizens produce ten visions	Four cities: approx. 100 citizens produce 50 visions
Experts’ & stakeholders’ recommendations	17 multidisciplinary experts produce 30 recommendations	Interdisciplinary teams of experts and stakeholders formulate 20 recommendations	Multidisciplinary teams of experts formulate 20 recommendations
Assembling visions and recommendations		Newsletter from the future: nine articles	Three scenarios
Internal prioritisation	Two lists of prioritised recommendations (citizens - experts)	Prioritised newsletter articles	Citizens assess scenarios according to desirability
External prioritisation		Public online voting	

Table 7: Steps of different case study processes

Strengths, Challenges and Lessons Learned

The presented method provides a standardised setting for transdisciplinary knowledge creation to foster (research) programme development. CIVISTI distinguishes between clear roles of citizens, experts and stakeholders to prevent conflicts of interest. Therefore the recruitment of citizens is crucial as citizens should not work in a profession which is associated with the discussed topics.

Also the modular process is flexible enough to be adapted to case-specific requirements. The individual modules, e.g. vision creation, still follow a standardised set of rules that ensure the overall quality of the process. For instance, the vision creation phase was initially a two day workshop and was efficiently scaled down to a one day workshop within ‘Future Foods’, with considerable effort, but without losing the essential elements of several feedback loops and different group as well as individual working phases.

A particular strength of ‘Future Foods‘ was the close connection of the process to a large body of expertise, namely AGES. This guaranteed access to a group of experts and stakeholders who are directly involved in education, research and health security as well as policy, thus allowing for a detailed definition of recommendations. As a result, experts were motivated to engage in interdisciplinary discussions, which in turn facilitated the interdisciplinary working phase and the expert/stakeholder workshop.

Within CIVISTI-AAL, setting up a steering committee consisting of business and city officials as well as scientists that was involved during the whole process, proved to be especially useful for the development of a network ensuring that results reached appropriate channels.

Overall, the method delivers new knowledge and crosslinks different existing forms of knowledge, but it is also more expensive than focus groups. It should be understood as a complex communication method; as a result, there is the need for sufficient resources, i.e. training of moderators, preparation of information material, time for assessing visions and recommendations. If these resources and competencies are not available, it may be more useful to use the concept of small focus groups.

CIVISTI is a very open approach that is easily applicable to grand topics; however, difficulties may arise when it is adapted to very specific topics. The visioning phase is also delicate, as the whole process refers to it and builds upon it. Here the training of capable facilitators is essential. Recruiting citizens is another step that needs special attention since a high heterogeneity of panels (and at table level) is crucial to the discursive process. Also the frequent communication with citizens strengthens their loyalty and commitment to the process which is important for a sufficient rate of mobilization for the second round of citizen consultations.

A certain weak point of the method is the possibility that such engagement activities lack a proper link to the intended addressees, but this may be also seen as a general problem of such methods. Nevertheless, constant involvement of stakeholders and experts during the process generates commitment to the process and its results, which for itself serves as a communication channel for the results to the addressees.

Finally, CIVISTI is a new method and it still needs further analysis and development at the methodological level. Nevertheless it has been mapped as one of numerous engagement methods within EU policy making (Engage2020, 2015) and will be used for a large consultation process on Horizon2020 in 30 countries within the EU project CIMULACT in 2016-2017.

References: Page 426

Shaping Future

New Methods for Participatory Technology Foresight

Marie Heidingsfelder, Simone Kaiser, Kora Kimpel
and Martina Schraudner

Abstract

By synchronising long-term research trajectories with public preferences, the viability of scientific and technological advances can be ensured. At the same time, the engagement of the public in an early phase of the innovation process is a challenging task. To overcome this challenge, the interdisciplinary research project Shaping Future has developed a process model for participatory foresight that is centred on approaches from both design and the social sciences. The developed methodology reflects key principles of the European Commission's Responsible Research and Innovation (RRI) Framework and fosters early engagement and interdisciplinary collaboration. Our paper presents the theoretical and empirical findings that undergird this project and its results, including the developed methodology.

Early Public Engagement as Impetus for Research and (Technology) Development

Societal acceptance is vital for the implementation of research results and the success of innovations. As current debates – for example on the transition of the energy sector from fossil to regenerative sources, or on genetically modified food or fracking methods – show, citizens do not accept technological innovations or support their implementation if they do not see their societal relevance and their added value. "Scientific-technical inventions are not automatically relevant to society. […] It is not enough to offer inventions; they must address societal needs and requirements" (Grunwald 2012, p. 75). Hence participative technology development processes which allow the public to become actively engaged at the initial stage of technology development gain more and more importance. Recognising the value of public input, the European Commission has declared the cultivation of a participatory, knowledge-based innovation culture and the transformation "from science in society to science for society, with society" to be major parts of its political agenda (Owen et al. 2012). However, the engagement of the public in an early phase of the innovation process is a challenging task; it requires a systematic method that can enable people both to think in terms of societal and technological co-evolution and to anticipate their future needs and wants. To this end, the interdisciplinary research project Shaping Future has developed a process model for participatory foresight that is centred on approaches from both design and the social sciences.

Early Public Engagement as a Methodological Challenge

Innovation research has shown that integrating laypersons as “experts in their experience” into the innovation process could help to develop products and services that truly meet the general public’s needs and foster the viability of products (see e.g. Chesbrough 2003; Schraudner/Wehking 2012). Yet, when it comes to developing long-term research agendas with societal actors, there are some difficulties which need to be kept in mind as methodological challenges:

Different (pre-) conditions and patterns of thought

The requirements, needs and motivation of involved stakeholders – such as decision-makers, technological experts and the general public – deviate strongly. Those differences result in diverse evaluation schemes and diverse language and action patterns, finally leading to communication barriers and unbalanced power structures that hinder a dialogue on equal terms.

The limits of language are the limits of the world

Established language-based methods – such as surveys, interviews or dialogue platforms – often have the disadvantage that language must always refer to today’s existing system of concepts. The description of technologies which go beyond the already known and feasible today can therefore hardly be achieved.

The Collingridge dilemma

Participatory technology foresight faces a double-bind problem: The full functionality and impacts of a technology cannot be easily predicted until this technology is sufficiently developed and widely used. However, once it has been developed, any substantial changes are difficult.

Motivation of participants and stakeholders

Participatory processes – like popular referenda, citizen surveys and dialogue events – become more important and common on municipal, regional and national levels. However, engaging citizens in research agenda setting processes is a challenging task, because of the long time horizon and missing prospects for application. Especially citizens who do not have a professional or personal interest in contents and processes of research are difficult to motivate. Such an approach requires a process design that makes participation not only possible but also attractive.

To overcome these methodological challenges, Shaping Future has developed an interdisciplinary methodology that promotes innovative forms of preference articulation.

The Project Shaping Future: Methods for Participative Technology Foresight

To enable a societal dialogue in a very early stage of the innovation process, the research project Shaping Future sought to empower laypersons to articulate their expectations of prospective human-machine interactions. This focus was chosen because it is expected to play a key role in future societies and because it is accessible and particularly important for laypersons. The core of the approach is a multi-staged co-ideational process that is realized in a succession of workshops with laypersons. These workshops and the laypeople’s input are conceptualised, moderated and evaluated by designers and researchers.

In an exploratory stage of the project (2011-2012), 146 laypersons (such as pupils, students and professionals with different backgrounds) were enabled to articulate their expectations of prospective human-machine interactions. These ideas and visions of desirable futures served as a basis and provided new impulses for specialists from a range of disciplines: Using technology roadmaps, these specialists could develop need-oriented technology roadmaps.

In the main project (2014-2017), the co-ideational process and the developed methodology are currently validated with highly heterogeneous groups of laypersons. Based on the exploratory stage the workshops focus on future human-machine interactions in the areas of “new relationships”, “health”, “work” and “mobility”. The following Figure 11 shows the co-ideational process and its participants in more detail and demonstrates how the process is validated and extended in the project’s main stage.

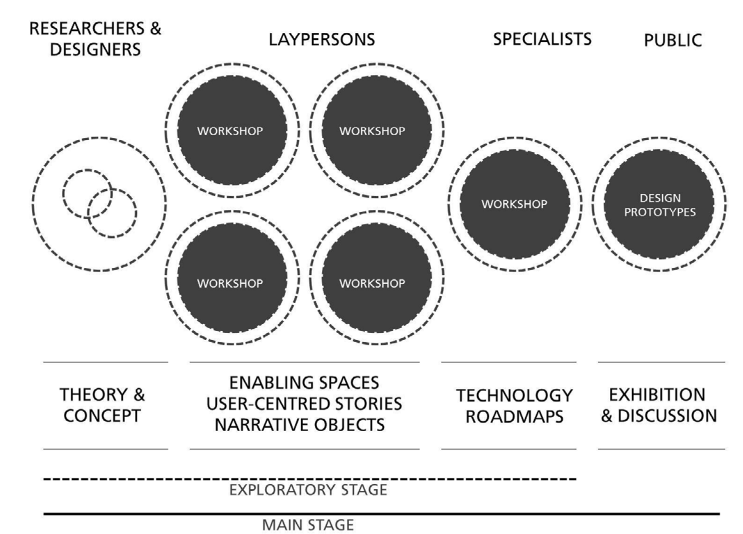


Figure 11: Process and outcomes of Shaping Future[1]

To evaluate the needs, the ideas, discussions and visions of the participants are transcribed and analysed. The collected data and additional interviews are conditioned with "traditional" methods from social sciences like terminology clusters, databases and qualitative content analysis. Furthermore, the layperson's perspectives and visions are materialized in form of narrative objects that offer additional dimensions of analysis.

The Role of Design

In Shaping Future, design know-how provides a range of practical tools for participatory processes. By engaging multiple senses and adding a non-verbal dimension to interaction, the limits of purely verbal expression can be transcended in innovative articulation formats like enabling spaces (Peschl 2007) or narrative objects. The latter aims at envisioning forms of human-machine interaction rather than providing models for particular semi-finished technologies. Participants are asked to speculate on ways in which their needs and acceptance thresholds could be materialised and choose materials from a wide and varied storage. The object-related formats lead very intuitively to translate individual ideas and implicit knowledge into visual symbols, thus making them explicit (Martin/Hanigton 2012). The resulting narrative objects "materialize a need" and show aspects of the context of use, the technology, the aesthetics and the quality of material. Their function is twofold: (1) They enable participants to think beyond existing boundaries and to articulate demands towards a still unknown future; and (2) they offer a translation format for heterogeneous groups and also for the group of specialists that develops technology roadmaps.

In a further step of the main project (2014-2017), some of the technology roadmaps will be transformed into speculative design prototypes and exhibited in a public space. The idea behind is to "invert" the dialogue between specialists and laypersons by presenting the specialist's results and their discourse in the public. The speculative prototypes will be developed by teams of designers and specialists. As tangible objects, they represent perspectives and controversies on possible futures. They aim at opening discussions and inspiring a multitude of stories on future technologies and can thus qualify as an example of design fiction (Grand/Wiedmer 2010). To foster engagement and discussions, visitors of the exhibition will be enabled to interact "multidimensionally" with the speculative prototypes and to give their feedback. To evaluate their reactions, the exhibition space offers technologies like eye-trackers. As the exhibition space is located in the centre of a large German city and free of charge, diverse people can be addressed.

Co-creation and Diversity

Shaping Future's methodology is based on the creative and innovative potential of collective decisions (Woolley et al. 2010) and its results are legitimated through the participation of diverse groups of participants. In accordance with the "social shaping" approach (Jørgensen et al. 2009), each group of participants is diversified based on age, gender and background

to foster diversity in perspectives. The interaction formats and methods provide a "common cognitive ground" for the participants and allow combining "tacit" and "explicit" knowledge (Nonaka 1991, p. 168). For those forms of knowledge production, however, a deliberate interaction management is required and workshop-facilitators have a key function when it comes to explain the approach and to integrate diverse participants. The developed scenarios and narrative objects reflect the multitude of perspectives among the participants und provide an inspiring and interesting basis for the involved specialists. While expert discourses on future technologies are often unidirectional and technology-driven, Shaping Future thus fosters a diversity of directions.

But diversity is not only important for lay participants, but also for the involved specialists who come from different disciplines and research contexts. Bringing together their knowledge to develop shared and interdisciplinary technology roadmaps, so-called "silo" knowledge (Blackwell et al. 2009)[2] can be overcome; and scientific topics and problems that are located at the edge of or between disciplines can be addressed. Reflecting these two dimensions of diversity, Shaping Future induced need-oriented and interdisciplinary visions of future technologies that strongly deviate from unidirectional "technology push" visions.

Conclusion: Shaping Future as a Tool to Implement Responsible Research and Innovation

In technological innovation, the consumerist model of innovation is still dominant: The public are cast in the role of users of the technology (Blackwell et al. 2009, p. 59). Simultaneously, the value of public engagement in innovation processes is increasingly recognised in research policies and in the scientific community. In this context, the research project Shaping Future has adopted an approach that radically "inverses" the consumerist model of innovation and engages citizens in a very early stage of technology development. Approaches from both design and the social sciences were combined to develop a systematic process model for participatory technology foresight.

As a result, the developed articulation formats could help overcome communication barriers and transcend purely verbal expression by engaging multiple senses. The project results in the development of original suggestions for future technologies that differ from research-driven suggestions and provide a range of valuable starting points for the specialists and for potential research agendas. On a methodological level, the project results in original interaction formats that allow a participatory and interdisciplinary dialogue. In the conception and evaluation of the project, the collaboration between designers and (social) scientists offers valuable interdisciplinary insights and provides itself a promising research field. What challenges and chances such interdisciplinary approaches might entail remains to be established by future research.

The developed process represents an innovative and interdisciplinary methodology to foster need-oriented research planning that is capable of integrating a wide variety of societal actors like representatives of civil society, researchers and policy-makers. Fostering early public engagement and interdisciplinary research, the approach complies with four of the six key principles of the European Commission's Responsible Research and Innovation (RRI) Framework: (1) engagement, defined as "including all relevant social groups in the innovation process"; (2) ethics, defined as "societal relevance and acceptability of research and innovation outcomes"; (3) gender equality; and (4) governance (by defining need-oriented research agendas). Nevertheless, the inclusion of laypersons to date was limited to a relatively small number of participants. Further research on the public exhibition and discussion should shed a light on the challenges of science communication with speculative design objects.

References: Page 426

Enriching the Methodological Scope of Technology Assessment

Initial Insights from SYNENERGENE, the Mobilisation and Mutual Learning Action Plan on Synthetic Biology

Steffen Albrecht, Christopher Coenen and Harald König

Abstract

Though the field of synthetic biology is still at an early stage in its development, there have been a number of technology assessment (TA) activities conducted in recent years outlining its potential ethical, legal, and societal implications. However, most of these activities rely on expert knowledge and do not engage the broader public. The EU-funded project SYNENERGENE extends the methodological scope of technology assessment by bringing together stakeholders from science, policy making, industry, civil society, and art into dialogue and mutual learning processes.

This paper takes stock of the various methods and presents initial experiences with the methods used in SYNENERGENE and contrasts these with more traditional TA activities on synthetic biology. The paper considers the ways in which the concept of mobilisation and mutual learning – as part of the framework of Responsible Research and Innovation – can enrich the methodological scope of TA of emerging technologies.

Early Engagement as a Challenge to Technology Assessment Practices

Technology assessment (TA) is future-oriented. By seeking to assess the ethical, legal, and societal aspects (ELSA) of technologies as well as by advising policy, TA typically draws on sources of existing information and knowledge and attempts to anticipate future developments and governance needs. In recent decades, it has developed a range of methods and approaches that help to derive robust and prospective assessments of technological developments (Grunwald 2009).

In recent years, the focus of TA has shifted from assessing established technologies to new and emerging technologies, such as nanotechnology (Grunwald 2012). Two trends, both captured and combined in the term "early engagement", have accompanied this shift in focus: the turn to participatory forms of TA that not only draw on expert knowledge, but also involve stakeholders and the broader public (Jasanoff 2003), and the move "upstream" in the innovation process, from the final products to the sources of innovation in research and development processes (Wilsdon/Willis 2004).[1]

The development of more participative forms of TA rests on the assumption that the knowledge base should be broadened, that societal values should be taken into account in the broadest possible sense, that the search for solutions to newly emerging problems should be stimulated, that the process allow for changes of opinion among those involved and be open to critique by those affected in order to further endorse the legitimacy of its outcomes (Bechmann 1997; Grunwald 2002).

The rationale behind turning to early phases of technological innovation pivots on the assumption that the process of development is more open, and that it should thus be easier to influence the development in ways that lead to results that are more desirable for society. By the time technologies are ready for the market often too much has already been invested to legitimate the introduction of major changes, and lock-in processes arise, even in the light of low public acceptance of the products (van Doren/Heyen 2014). Furthermore, the need for orientation in this phase is high, given the particular degree of uncertainty with respect to the future prospects of an emerging technology.

But openness in early phases of innovation also poses problems, as the Collingridge dilemma (Collingridge 1980) points out. As long as uncertainty and limited knowledge as to how a technology will develop in the future persists, how is it possible to give reasoned advice on possible approaches to be taken? Another problem of early participatory assessments is not only that the knowledge of the specific technology is limited, but also the public awareness thereof.[2] And, finally, the question of who will be affected by the new technology and which stakeholders should be engaged in the early assessment often remains unclear.[3]

Thus, while there are many good reasons for early engagement with emerging technologies, there are also difficulties in carrying out corresponding activities. This paper seeks to contribute to the discourse on early engagement by drawing on the example of synthetic biology, a techno-scientific field still in its infancy, but which has already been the subject of a number of assessment exercises. The paper also discusses previous assessments, and presents the concept of, and first experiences with, new forms of early engagement currently being explored in the context of the SYNENERGENE project, a mobilisation and mutual learning action plan (MMLAP) on synthetic biology funded by the European Union.[4]

Synthetic Biology and its Assessment(s)

Originating in the early 2000s, synthetic biology is seen by various players as a new and emerging interdisciplinary field of research and innovation that has its roots in genetic engineering. As the field is still in its nascent phase and there are only few products on the market that may legitimately qualify as "derived from synthetic biology" – i.e., approaches

that go beyond "traditional" genetic engineering –,[5] it would seem too early to make reasonable predictions about its future relevance and prospects. Instead, synthetic biology appears to fit well into the pattern of "hope, hype, and fear" technologies (Sauter 2011). Hopes are exemplified by David Willets, former Minister of Science in the UK, who coined the phrase that synthetic biology would "heal us, feed us, fuel us" (Willets 2013). The hype becomes apparent by the rapid increase in research funding and research activities (Oldham et al. 2012) and in the attention the field is given by ELSA researchers.[6] With regard to fears, synthetic biology is repeatedly mentioned in the context of (emerging) global risks that "threaten human civilisation" (Global Challenges Foundation 2015, see also World Economic Forum 2014).

Numerous TA institutions, governmental and civil society organisations (CSOs) have addressed the ethical, legal, and societal aspects of synthetic biology (Albrecht 2014). Although various actors have been involved in the assessments, there are only few examples of public engagement. Most studies rely on the knowledge of experts in science, policy-making, and ELSA research. Accordingly, the dominant methods of assessment are literature (or desk) research, expert hearings, or workshops. This stands in contrast to the prevalent recommendations in these studies, which stipulate that more public dialogue is needed to develop the field of future synthetic biology in a responsible manner.

One reason for this reserve with respect to more ambitious public engagement could be that actually implementing early engagement in the field of synthetic biology poses methodological challenges. Experts, who have engaged with the public, report that participants found it difficult to formulate clear opinions about synthetic biology (Bruce 2010). CSOs have been reluctant to engage in public debate (with a few exceptions, such as the ETC group and Friends of the Earth). Kaebnick et al. (2014, p. S18) point out that while participants in deliberative processes should be open-minded for public deliberation to function, they often hold fundamental beliefs about technologies. Another methodological problem with early engagement arises from vested interests of stakeholders involved in science policy-making (König et al. 2013).

Mobilisation and Mutual Learning as the Methodological Enrichment of Technology Assessment

New methodological approaches to early engagement have been proposed based on the notion of "Responsible Research and Innovation" (RRI). RRI departs from a view of science and technology as inherently interwoven (von Schomberg 2012), with blurred boundaries between research and application contexts. Since, as yet, only tentative knowledge is available on the implications of emerging technologies, the traditional division of labour in TA between experts and policy-makers is no longer feasible. Rather, RRI aims to bring together societal stakeholders with researchers and innovators in order to collectively – and in a mutually responsible manner – shape research and innovation processes towards ethically acceptable, sustainable, and socially desirable outcomes (von Schomberg 2013).

However, the debate on RRI so far has left open the question as to how the concept could be put into practice (Wickson/Carew 2014; Grunwald 2013). Nonetheless, RRI already affects European research programmes by requirements to reflect RRI in new research proposals (e.g. in the Horizon 2020 programme) and by way of several projects devoted to its further development. One such project is SYNENERGENE, a MMLAP in the field of synthetic biology. The project is geared towards mobilising a broad range of stakeholders to discuss what is societally desirable and how to collectively shape the development of synthetic biology accordingly. With more than 100 events and activities organised across Europe and overseas over a four-year period (2013-2017), the 27 partner organisations intend to foster a process of mutual learning and reflection among stakeholders of synthetic biology.

The activities are organised in four platforms, addressing issues of real-time TA (platform 1), public involvement (platform 2), artistic and cultural reflection (platform 3), and research and policy (platform 4). Additionally, open forums such as the "civil society forum" and special interest groups, such as one on DIY biology – formed during the project in reaction to the rise of DIY biology –, help to maintain contact with stakeholders and current developments in synthetic biology. Whereas some of the work follows traditional TA methods, the project experiments with several new forms of early engagement. Some examples from recent events provide an impression of the methods explored in the context of SYNENERGENE:

- With regard to moving upstream, SYNENERGENE cooperates with teams of young researchers in exercises of "real-time TA" (Guston/Sarewitz 2002). Students and other young participants in the annual International Genetically Engineered Machine (iGEM) competition team up with TA researchers in formats called "frame reflection lab", for example, and in the development of application and techno-moral scenarios (including the generation of "techno-moral vignettes"). SYNENERGENE, which cooperates in this context with the iGEM Foundation, addresses iGEM participants as the next generation of synthetic biology researchers and attempts to stimulate among them a more differentiated reflection and awareness of the wider implications of their work.
- SYNENERGENE also reaches out to the general public with the help of Ecsite, the European network of science centres and museums. Together with several science centres, Ecsite is currently developing educational material and exhibition artefacts for use in the centres, but also in schools. In this way, young people, as well as their parents, can acquire hands-on experience with synthetic biology and become engaged in reflections on the field. Furthermore, their views and opinions are collated in the centres and fed back into the project so as to inform researchers and policy-makers.
- Artists, film-makers, and theatres help to open up new perspectives and stimulate reflection on synthetic biology. The SYNENERGENE partner Biofaction organised the BIO·FICTION Film Festival in 2014, with films, bio-art, and DIYbio workshops attracting around 100 visitors to the Museum of Natural History in Vienna, Austria. The University of Southern Denmark invited an artist-in-residence, and Freiburg's theatre organised a two-day festival of performances related to synthetic biology, in July 2015. In all these activities, artistic expression provides a medium for reflecting on complex techno-scientific issues and helps to open up new spaces for deliberation, thus avoiding the familiar impasses of past discourses.

These new methods of public and stakeholder engagement – together with more traditional methods, such as expert workshops with policy-makers, scientists, or CSO representatives as well as public consultations – are applied in SYNENERGENE to stimulate reflection on synthetic biology, but also to generate input from societal stakeholders for research and debates on policy. This approach addresses the problem of limited awareness of emerging technologies by addressing multipliers and creating initial societal awareness. Hands-on experiments in science centres and in art can function as aids for overcoming the abstract character of technologies, to date more visionary than tangible. Such artistic work is also of interest with regard to the ongoing methodological and theoretical efforts in TA on the role of visions of the future and of imagination in science, technology, and society.

By using various methods and addressing a broad range of stakeholders beyond the "usual suspects", the project is able to cope with the difficulties connected with determining core issues in synthetic biology and the question which stakeholders are likely to be affected. Last but not least, the activities should be considered as first, experimental steps that also aim to foster a learning process within the TA community on best practices in early engagement.

What is on the Horizon for Early Engagement in Technology Assessment?

What can we learn from the experiences in SYNENERGENE for practising early engagement with emerging technologies? The project is still in an early phase and lacks systematic evaluation of the activities thus far. But it has managed to successfully mobilise some major players in the field, such as iGEM, Ecsite, bio artists, DIY biologists, and TA experts. The cooperation and communication among these different stakeholders has proved challenging at times, for example, with tensions between theoretically oriented researchers and practically oriented science communicators, or between industry and civil society organisations. Yet formats such as artistic reflections or players like DIY biologists can help to turn these tensions into constructive discourse by bringing into play new perspectives on synthetic biology.

It is still too early to look for practical changes or a significant impact on the field of synthetic biology. The insights generated over the course of engagement activities have yet to be transferred into research agendas and policy-making. What can be observed is mutual learning – from very different perspectives – among those involved in technology assessment and public engagement, with insights not only related to synthetic biology, but to emerging technologies more generally. Much of what can be learned is not codified knowledge, but rather tangible know-how.

Given that the approach of MMLAPs is still in its experimental phase and our experiences are so far limited, the focus should thus be placed on the careful evaluation of the activities and their outcomes. As the results of such evaluations – which are, in fact, a core element of SYNENERGENE – will be largely available only in retrospect, further projects or similar activities of "reflexive TA" will be required to pick up and reflect the results and integrate them so as to improve the practice of early engagement with emerging technologies.

References: Page 427

Talking about What?

Early Engagement Activities in the Context of Neuro-Enhancement Technologies

Ronja Schütz, Christian Hofmaier,[1]
Núria Saladié, Gema Revuelta and Elisabeth Hildt

Abstract

Within the concept of responsible research and innovation (RRI), innovation processes are to be influenced at an early stage, both to prevent technology development from steering in unwanted directions and to enable easier access to scientific knowledge. Engaging the public pro-actively, however, poses considerable problems. This contribution will discuss the challenges posed by stakeholder participation in the recruiting phase of early engagement activities as well as during the events themselves against the background of the ongoing European project Neuro-Enhancement: Responsible Research and Innovation (NERRI). The project aims to foster societal dialogue on neuro-enhancement across Europe, to shape a normative framework, and to pass governance recommendations on to the European Commission. In the case of NERRI, the main problems in engaging the public originate primarily in the lack of familiarity with and vagueness of the term "neuro-enhancement".

Responsible Research and Innovation in NERRI

In recent years, the concept of responsible research and innovation (RRI) was introduced by the European Commission as a part of its Science in Society program (SiS)[2] to create a tool to ensure that scientific research and the introduction of new technology proceed in a way that is (ethically) acceptable, sustainable, and socially desirable (von Schomberg 2013).

As insurance for the social acceptability of technologies, deliberative democratic elements were introduced to broaden the debate about future developments. The goal was to create " 'the best science for the world' not just 'the best science in the world' " (Morten Østergaard cited in Owen et al. 2012: 753).

The search for the legitimate and best impact of science and technology development for society is the foundation of this new concept. Therefore, it differs from the traditional methods of technology assessment by addressing not only the negative outcomes of a technology but also its positive impact (see von Schomberg 2011: 40).

RRI is promoted by the European Commission through the 7th Framework Program and more so in Horizon 2020. Within the 7th Framework Program, the project Neuro-Enhancement: Responsible Research and Innovation (NERRI)[3] is being conducted in eleven European countries, combining the work of 18 partners. The project is aimed to foster a societal dialogue on neuro-enhancement (NE) across Europe by conducting mobilization and mutual learning (MML) activities that engage scientists, innovators, societal actors and the public. Within the NERRI project, the term "neuro-enhancement", although combining many different methods and aims, is understood to be restricted to the use of pharmaceutical or technological means to enhance the mental performance of healthy persons.

Using the MML outputs and knowledge drawn from expert interviews, the project plans to develop a normative framework for the use of any (possible future) NE technology. Based on this, recommendations for future policies will be generated to make suggestions to the European Commission about ways to conduct responsible research and innovation in the field of NE.

Public Engagement Activities

Based on experience running public engagement activities within the NERRI project, two problems that arose in various contexts can be described as (1) the difficulty to enlist people and stakeholders to participate in public engagement activities and (2) the lack of familiarity with the term NE, which be associated with the diverse nature of the different technologies included under the umbrella of NE (e.g., educational activities, drugs, technological devices, and surgical procedures).

Generally, in order to be interested, people must already know something about a specific topic in order to be willing to spend some time discussing it or an evening at a public engagement activity. The lack of familiarity with the term NE or with considerations concerning (possible future) enhancement technologies may be one reason for a lack of interest. This problem was encountered not only with the general public but also with stakeholders. Some stakeholders did not consider the topic to be relevant, others did not want to get involved in the debate, while still others did not know much about it.

Solving stakeholders' motivational problems hindering participation in public engagement activities

In the process of organizing a public engagement activity, participants have to be recruited. This is applicable to all kind of activities, and the case of NE is no exception. However, this field has some inherent qualities that make collaboration of others especially problematic.

The following thoughts are based on the experience of the NERRI team of the Universitat Pompeu Fabra (UPF), which has organized seven MML activities within NERRI which have involved more than 140 people. In these, two major obstacles were identified as being typically encountered regarding stakeholders' lack of willingness to participate in public engagement activities. The first of these hindrances is the uncertainty that inevitably still surrounds the topic of NE (cf. Section 2.2). The concept of NE is not widespread and generally

rather unknown, including among civil society organizations, and this lack of familiarity is sometimes translated into a lack of motivation to participate due to the discomfort that usually comes with admitting ignorance. Furthermore, NE is frequently perceived as something not far from science fiction or as a pseudo-science, which automatically turns it into a second-rate discipline for scientists as they tend to avoid any subject that might become tabloid material.

To overcome these difficulties, public engagement activities were specifically designed so that they started with an introduction in order to make sure that all participants had some basic knowledge of NE and by granting a certain level of anonymity when participants expressed their opinions. In Spain, two major debates were organized by UPF in order to bring NE closer to society, to start a citizen discussion and to try to overcome the obstacles mentioned above. The first of these debates, named "SuperMI", took place in the science museum of Coruña MUNCYT. The session started with a first round of presentations from experts in various fields, explaining the state of the scientific knowledge about NE, its commercial possibilities, and legal considerations. After the presentations, members of the audience answered questions related to their personal opinions about NE and its use. Attendees were able to contribute to the questions through an automatic and anonymous voting system that collected all responses and screened them in real-time. The results constituted a source of material that stimulated an open debate between the different stakeholders. A second "SuperMI" debate was organized in the biggest science museum of Barcelona, CosmoCaixa, which was designed like the first debate with a round of presentations from experts, followed by a real-time voting round, and a final part dedicated to debate.

In both events, participants were given an exit poll to evaluate the activity. Participants considered the event a success. The vast majority of attendees felt that the format and the content of the session allowed them to learn about a topic they had known nothing about and even to form an opinion about it. Moreover, most participants highly appreciated the fact that a real debate emerged between NE specialists and non-expert citizens.

Apart from the debates, another strategy to overcome the unwillingness to participate in public events was the creation of a multidisciplinary local committee. The Spanish Committee for the Support of Responsible Research and Innovation in the field of Neuro-Enhancement (NERRI Spain) was constituted during the consortium meeting of the NERRI project in Barcelona in November, 2013. All the institutions involved made commitments to give support to the project by sharing their knowledge and their opinions, whether that of the institutions or individuals, as well as by disseminating the NERRI activities and documents among their members and social networks. This approach led to a greater willingness of members to participate in an activity. Providing information about public engagement events through peers (in the case of professionals and civil society organizations, for instance) or friends (in the case of social networks´) is therefore another viable solution to the problem posed by motivational problems.

Talking about the unfamiliar concept of neuro-enhancement

<u>Stakeholder interviews</u>

In Germany, the NERRI members of the Universities of Mainz and Stuttgart conducted 19 interviews with various stakeholders from different backgrounds – from representatives of the pharmaceutical industry to medical doctors, legal specialists or patient support groups - to identify the status quo concerning knowledge about and attitudes towards NE technologies. Gathering the knowledge of experts and representatives of potential target groups alike was the first step toward identifying issues worth discussing in the later phases of the project (and therefore the first step toward responsible research). While these stakeholders had deep insight into their specialties and were informed about the meaning and scope of the concept of NE, most of the interviewees were still not certain about the term.

To illustrate the problems encountered during the interview phase an analysis of the interviews was conducted, identifying the associations people had with the term of NE. The interviewees were briefed about the definition of the term NE but were still struggling to put it into perspective.

Therapeutic: cognitive enhancement, memory enhancement for older people, enhancement for mental restrictions, for ADHD therapy, “happy pills” for people with depression, neuro-modulation
Metaphors: brain-doping, transhumanism, iron man syndrome, smart drugs, happy pills, doping in sports, abuse of medicines, off-label use, popping pills, to get oneself into shape, to ‘inject’ oneself into shape
Kinds of enhancement: creative enhancement, preventive enhancement, memory enhancement, motivational enhancement, enhancement for stimulating effects, cognitive enhancement
Substances/techniques: dextrose, coffee, energy drinks, Ritalin, drugs, medications, amphetamines, stimulants, brain stimulation, technical devices generally
Traditional or accepted methods: memorization techniques, retroactive interference, lifestyle, diet, enhancement by wearing glasses
Negative associations: missing creativity, fewer moral values, less self-confidence, personality, risk of losing other abilities, risk of addiction

Table 8: Aspects discussed and metaphors used by the interviewees

Table 8 shows the various aspects and metaphors which were referred to throughout the interviews. For example, although the term had been explicitly explained to them as referring to nontherapeutic approaches, the table shows that people still thought about therapeutic possibilities. The metaphors used illustrate the problems they had categorizing the term. People’s perceptions ranged from various sports metaphors to drug-related associations as well as to transhumanism. While the creativity the interviewees used to encounter a concept that was unfamiliar to them is certainly an interesting observation and could be part of more scientific research, it is difficult to draw conclusions concerning NERRI’s goal – the generation of policy recommendations.

Focus groups

To gain detailed insights about attitudes towards NE, the German partners conducted several focus groups at the University of Stuttgart and at the University of Mainz, i.e., moderated group discussions with 10 to 12 people with a NE overview at the beginning to counter participants’ lack of information and to make sure all participants had a similar level of knowledge. Besides gathering data on the participants’ attitudes, the focus group design made it possible to identify the issues participants are most concerned about. Furthermore, the main lines of arguments can be determined and statements identified which lead either to consensus or dissent.

During the discussions it became clear that, despite the introduction given at the beginning of the session, some of the participants were unsure about their own understanding of NE,

which had effects on the way issues like the regulation of NE were discussed. Lacking a solid grasp of the term, these participants tended to associate NE with concepts known to them and transferred the attitudes to the subject at hand. Table 9 shows how one and the same participant changed his attitude towards NE according to his association.

(i) “On the one hand cyclists, or athletes in general, are condemned for their use of enhancers. On the other hand we are asked to discuss about allowing neuro-enhancers to enter society? That is inconsistent.” »» NE = doping
(ii)”The question is about accepting this [NE] as a society. Do we turn broad drug use into something common and tolerated in our society? Or do we treat them as illegal? If the latter, it is prohibited and the possession criminalized.” »» NE = drugs[4]
(iii)”Generally, I would treat it [NE] as a prescription drug and I would not call it ‘enhancement’ but ‘doping’.” »» NE = doping

Table 9: Fluid associations towards NE

In statements (i) and (iii) the participant clearly associates NE with the term doping and recommends NE be regulated like prescription drugs. In statement (ii) he switches to associating NE with illegal drugs and proposes criminalizing its possession, which is a more severe regulation than treating NE as prescription drugs. This example of fluid associations shows, on the one hand, the uncertainty which characterizes discussions about NE. On the other hand, the example illustrates that, as experienced in the focus groups, the associations tend to be to negatively connoted terms.

Conclusions

As has been described, the obstacles encountered doing RRI concerning NE are mostly based on a lack of information. Although motivational problems can be solved by granting a more anonymous approach to gathering the input of stakeholders, considerable problems regarding the relevance of the results remain. That means that even though it is feasible to conduct a societal dialogue on a (possible future) technology such as NE, the question remains as to how policy advice can be given on the basis of such an undefined field as NE.

To describe the views, attitudes, and expectations of the public remains difficult if the participants in public engagement activities have difficulty grasping the concept they are confronted with. The novelty of the concept leads to insecurity in how to evaluate it and react. The reaction in the case of NE is association with known techniques that in this case have a negative connotation. While the idea of RRI may be perfectly fitted for a further developed technology, in the case of a new one such as NE the results are limited. Although it is possible to give detailed answers to the questions that the public is concerned about (e.g., children being under the influence of some pharmaceutical enhancers) and regarding where boundaries can be defined or lines drawn, the full potential of RRI cannot be reached. The implementation of RRI in its entirety - that is, not only to prevent negative outcomes but also to give an overview of the possible positive impact - cannot yet be achieved for NE.

References: Page 428

PART II

SUBJECT AREAS OF TECHNOLOGY-ASSESSMENT PRACTICE

RESPONSIBLE RESEARCH AND INNOVATION FOR ENERGY TRANSITIONS

Articles from the PACITA 2015 Conference Sessions:

(25) Responsible Research and Innovation for Energy Transitions

Fostering Responsible Action on the Consumer Side

A Role for Local Citizen Panels in Energy Transition Strategies?

Georg Aichholzer

Abstract

The paper reviews different types of involving citizens as consumers into measures of energy saving and lowering carbon emissions and draws on results of a local-level (e-)participation approach combining long-term individual consumption monitoring with feedback from carbon footprints, provision of supporting information, and opportunities for exchange among participants. In a set of similarly organised participation processes in Austria, Germany and Spain citizen panels collaborated with local governments over up to two years on achieving a reduction of CO_2 emission levels by at least 2% per year. The results show that the specific participation format and the local level with its advantages related to community aspects are a suitable route for actively involving especially already sensitised citizens into energy saving and climate protection, aiming at a reflection and pro-climate change of their everyday behaviour.

Introduction

The targets of the European Union's 2030 framework for climate and energy policies are ambitious: reducing greenhouse gas emissions by at least 40%, increasing the share of renewable energy to at least 27%, and increasing energy efficiency by at least 27% below 1990 levels by 2030.[1] Achieving such a far-reaching transformation in energy provision and consumption depends to a large extent on the cooperation of actors on the demand side, in particular private households. Adoption and practice of environmental actions in households are also crucial for progressing towards sustainable consumption (cf. Scott et al. 2015). A fast growing body of research is studying diverse approaches of public engagement and accumulating empirically grounded knowledge on their respective merits for saving energy consumption and mitigating climate change (e.g. Whitmarsh et al. 2011; Peters et al. 2010).

This paper pursues two main objectives: first, to provide a brief review of participatory approaches involving citizens as consumers into measures of energy saving and lowering carbon emissions and, second, to focus on some key issues based on results from a particular long-term (e-)participation approach involving citizen panels. Empirical evidence on the latter stems from a field study on a set of similarly organised participation processes in Austria, Germany, and Spain.[2] Main results on participants' assessments of the process and its impacts have already been reported in Aichholzer (2014). In the present contribution the focus is on (1) reaching the target population, (2) achieving sustained engagement, and (3) measuring tangible impacts. A final section draws some conclusions on the potential as well as challenges of the specific participation format studied.

Multiple Ways of Engaging the Public with Energy and Climate Issues

Especially over the past decade the forms of engaging individuals and households with energy saving and action against climate change have been growing exuberantly. Along with the growth of public engagement, the support by electronic media in various forms of e-participation has proved increasingly useful. In particular the Internet holds enormous potential for information sharing, discussion, raising awareness, and mobilisation of collective effort as well as for collaborating on policy decisions and their implementation in the pursuit of climate and energy targets.

Whitmarsh et al. (2011) provide one of the to date most comprehensive collections of the variety of approaches to engage the public with climate change, including an attempt to structure the large number of participation activities. Table 10 presents a simplified version of this typology made up of three broad clusters differentiated by the scope of their principal aims:

Aim of activity	Format	Strategy	Variants
Awareness raising at public level	(a) Top-down (b) Bottom-up	Information provision and education	At-a-distance, use of multiple media
Behaviour change plus awareness raising	(a) Top-down (b) Hybrid (c) Bottom-up	Information, education, interactive involvement, data collection, monitoring, measurement, and feedback	(a) At-a-distance (b), (c) Involvement with groups, empowerment, long-term effects
Public involvement in climate change policy and decision making	Mainly top-down, some grassroots initiatives	Individual and group support, consultation, dialogue, deliberation	Engaging citizens and stake-holders, multiple methods

Table 10: Typology of climate change engagement activities. Source: Whitmarsh et al. (2011, p. 276), adapted

1. Raising awareness

A first class of engagement activities aims at raising awareness of climate and energy issues through the provision of appropriate information and various kinds of educational activities. Interventions are set top-down by governments or other public agencies as well as bottom-up by non-governmental or private organisations. Top-down examples are national programmes such as the ACT ON CO2 campaign in the UK which employed a mass media approach combining television, online, and press; a bottom-up example was the 10:10 campaign, mainly an online effort supported by the Guardian and other liberal media propagating a 10% reduction of carbon emissions at individual level by 2010 (Regniez/Custead 2011). The effects of such strategies have been assessed as meagre (see e.g. Borgstede/Andersson 2010).

2. Initiating behaviour change

A second group focuses on the more ambitious aim of pro-climate behaviour change. Again a variety of approaches is being practised (e.g. addressees, methods, media employed). They go beyond information and education and build on interactive involvement, monitoring, and tailored individual information support combining encouraging, enabling, and exemplifying, addressing both cognitive, affective, and behavioural dimensions. Individual projects are described in Peters et al. (2010, Chap. 9-15): In the UK the EcoTeams programme ran over 15 years and is regarded as one of the most successful examples. It stands for promoting pro-environmental behaviour through group activities on major environmental issues, combining tailored information provision, community building, social influence, measurement, and feedback over a couple of months. Community initiatives are an important sub-group, often initiated as grassroots movements such as the Low Carbon Community Network (LCCN). The ECHO Action programme was run in nine cities across Europe focused on three levels of engagement, from consumption and behaviour reviews to more simple improvements and finally substantial changes in homes, mobility behaviour and the like, including the use of monitoring tools.

A related group of behaviour change methods are various metering activities with individual feedback with tools such as smart meters or carbon calculators. Studies found energy savings ranging from 1% to over 20% (cf. Fischer 2008). Two other types of behaviour change approaches target individual households and/or individuals and focus on incentives and low-income groups. Examples are the electricity-saving premium and energy consulting for low-income households in Frankfurt. According to Rubik and Kress (2014) who provide an index for the comparative potential and impact of a variety of other measures in the housing sector, the latter has high potential and impact, the former high potential but (still) modest impact. In Australia the EnergySavers energy behaviour change programme also addressed low-income households; it reports also positive effects from a combination of information materials and group discussions within demographic groups (Hall et al. 2013).

3. Involvement in policy and decision making

Deliberation and consultation type approaches are classical methods in this third category. A prominent example is the perhaps largest-ever global citizen consultation process on climate and energy named WorldWideViews (WWV) which involved citizens from 38 countries (cf. Rask 2012). Further examples with links to policy and decision making are deliberative exercises at national or subnational levels (cf. Carson 2010). A method where citizens make choices about the allocation of financial funds to pro-climate projects is participative emissions budgeting (Cohen 2012).

In the remainder of this chapter we will focus on some key challenges of public engagement with climate change aiming at effective behavioural changes and CO_2 conservation as exemplified by results of the e2democracy project.

Reaching the Target Population

A key challenge of engaging the public with energy conservation and climate protection is effectively reaching all segments of society, particularly those with the highest potentials for improvements. Major determinants of success in this respect include participation format, information measures, recruitment strategy, and incentives.

The e2democracy project studied a set of seven largely identically organised (e-)participation processes at locations distributed across three countries: Bregenz and Mariazell region in Austria; Bremen, Bremerhaven, and Wennigsen in Germany; and Saragossa and Pamplona in Spain. Citizen panels were collaborating with local governments over up to two years (in the period 2010 to 2012) on the aim of reducing CO_2 emissions by at least 2% per year. They used a CO_2 calculator for bi-monthly individual consumption monitoring and information feedback on CO_2 footprints – with free choice of participation mode, via traditional means or via e-participation. Additionally the panellists received supporting information and had various opportunities for exchange at issue-specific meetings and events. The participation design was to allow for a maximum of openness to participation but demanded above average engagement because of the length of the process and the time for regular active contributions. Also the information measures were designed for a maximum of social inclusion. Measures for raising awareness and invitations to citizens used all sorts of communication media plus telephone surveys among the local populations. Personal invitation letters were most extensive in the Mariazell region, Bregenz, and Bremen. In Saragossa, the city council made use of direct contacts to citizens who had volunteered for participation in regional matters in previous projects whereas Pamplona mainly relied on interested citizens identified during the telephone survey.

Despite these preparations, the effective participation rates were far below expectations at all locations, in particular in view of results of the representative telephone surveys conducted before the start. When asked about their readiness to participate in a climate protection initiative with individual consumption monitoring, the range of positive responses by citizens had been between 69% and 92% at the seven locations (see Aichholzer et al. 2013). The actual figures in Table 11 are in sharp contrast to this high level and indicate a strong attitude-action gap.

	Austria		Germany			Spain	
	Bregenz	**Mariazell**	**Bremen**	**Bremerhaven**	**Wennigsen**	**Pamplona**	**Saragossa**
Status	Town	Region	City state	City	Town	City	City
Population	29,849	4,690	547,340	113,366	14,099	197,935	674,725
Participants registered	64	62	213	48	114	260	398
Participation rate	0.21%	1.32%	0.04%	0.04%	0.81%	0.13%	0.06%

Table 11: Participation rates. Source: Author

The seven panels started with a total of 1,159 participants. The participation rates in relation to population size in the different participating towns and regions lie in a range between only 0.04% and 1.32%. This reluctance to participate can be better understood given the fact that the invitation had openly communicated the required commitment to contribute actively over two years and that the motivation to participate largely relied on an intrinsic conviction and a sense of responsibility for the public good and future generations. Participants only received symbolic gratifications for their achievements and participation over the full length of the exercises and very small compensations for the time spent for accompanying surveys.

Interestingly the smaller locations were relatively more successful in attracting citizens for participation. Two factors seem to play a major role in explaining this result: one is the higher percentage of personal invitations at individual households; the other one is a community effect, including greater visibility of the initiative, a tighter communication network, and social obligation to participate at locations with smaller population.

In addition to the question how many of the target population were reached it is of equal interest which kind of profile the participants have. Crucial aspects are their interest in, attitudes to, and knowledge of climate change as well as their position towards actions against climate change. A cluster analysis was carried out based on the following eight variables:[3] information about climate change; satisfaction with measures against climate change; interest in politics; interest in climate policies; satisfaction with local participation opportunities; information on local actions against climate change; motivation by environmental concerns; motivation by energy cost savings. The analysis revealed three distinctive groups distributed as follows:

- one cluster of participants with above-average values in all but two variables representing the vanguard to be labelled ‘environmentalists’ (27.8% of the total);

- a second cluster showing values which oscillate around the mean and could be called already 'sensitised' citizens (50.9%); and
- a third cluster, finally, showing below-average values on all variables, most pronounced on information about climate change, can be addressed as 'less interested' compared to the rest (21.4%).

The composition at the local level showed big differences from this general pattern. In Bregenz, Wennigsen, and Mariazell up to three quarters of the panel were 'environmentalists' whereas these were a small minority in the Spanish panels. In sum, the results indicate a suboptimal reach into the actual target group (citizens who are still more remote from pro-climate lifestyles and would therefore have greater potential for improvements). This also points to the downside of the strength of community effects with a stronger role of personal recruitment patterns: it led to a composition of panels skewed towards individuals with a special interest in the issue, especially at smaller locations.

Achieving Sustained Commitment and Impact

A special challenge of the participation exercises in these local climate initiatives was their long-term duration of up to two years. This requirement was owed, firstly, to the need for monitoring individual consumption and CO_2 emission effects across different seasons, and, secondly, for controlling the stabilisation and sustainability of changes to pro-climate behaviour. However, for major learning effects and translation into behaviour changes to take place, a shorter period of monitoring with information feedback on carbon footprints should be sufficient. Moreover, the space for further improvements after the stabilisation of a pro-climate lifestyle shrinks. This created a dilemma between methodological and substantial requirements of determining the optimal process duration of such exercises.

Over two years of bi-monthly measurements some so-called panel attrition is inevitable, i.e. people dropping out over time. In the current case the drop-out pattern is interesting because the bulk of drop-out occurred between registration and first measurement round. During the first four months the local exercises lost between 33% and 58% of the participants. By comparison, the drop-out over the following much longer timespan of up to 20 months of periodic measurements was much smaller (on average 16% of the registration total). This pattern suggests that the starting phase is crucial and involves special difficulties which decide on the continuation or retreat of participants. Factors which could help reducing the drop-out at this stage are special attention to problems faced by participants, maximum responsiveness and provision of support, and usability of participation tools.

Evidence of Tangible Impacts

Engaging citizens with the target of reducing CO_2 emissions and lasting behaviour changes requires assessing the impact of such participation processes. The participation design in the

e2democracy project aimed at increased sensitisation and sustained changes towards pro-climate behaviour and offered the possibility to measure both CO_2 reduction and behaviour change achieved. The results to these effects showed a differentiated picture (see Aichholzer et al. 2016, Chaps. 10, 11, and 12, for details):

Three surveys were conducted trying to assess intermediate effects (e.g. individual and social learning, community building, etc.), and behaviour changes. The regular monitoring and feedback process with different possibilities of comparison served well as a tool for orientation and motivation. Being embedded in a collective process – the experience of being part of a local group and an international initiative – fostered community building, supported individual efforts, and motivated participants to change their behaviour. The results show that pro-climate awareness, attitude, and behaviour changes have taken place during the participation processes in all panels to different degrees. Increased climate awareness and pro-climate attitudes were observable to a large extent and attributable to the participation exercises. Changes of behaviour did not occur to the same degree, partly because this already took place before the participation exercises. The patterns of behaviour change largely confirm the 'low-cost hypothesis'; differences tend to be related to context conditions and options for alternative behaviour in each region. A number of community-related factors were positively related to behavioural change, such as common learning on climate change issues, deliberation, exchange of experience, particularly on the topic of CO_2 footprints and good practice, as well as the personal experience of effort enhancement and the removal of barriers through community support.

Data gathered via a CO_2 calculator provided a more tangible indicator of impact. The underlying data were reported by the participants bi-monthly, including detailed quantitative figures such as read from power meters and odometers, but also had to rely on more gross calculations and assessments in areas of nutrition and general consumption. CO_2 reduction was measured at two levels. At the individual level, around 60% to 70% of the participants in Austria and Germany improved their carbon footprint by at least 2% per year, whereas in Spain only every second participant reached this goal. At the collective level, the CO_2 reduction targets were reached in five of the seven panels.

Conclusions

Overall, the participation format studied in the e2democracy project proved useful to enhance responsible action on the consumer side. Its core elements are citizen panels collaborating with local government and consumption monitoring and information feedback on individual carbon footprints embedded into collective community initiatives with opportunities for exchange and social learning. Integral parts are participation opportunities for all and free choice of online or offline participation modes. The local level and social networks provide a promising route for this approach. Appropriately adapted, lowering the demand on participants by shorter duration of consumption monitoring and feedback, but with flexible advice packages according to individual needs, the approach could be tried at a broader basis. Major challenges are a wider reach into core strata of the society, influencing policies to enhance favourable material and institutional context conditions to support pro-climate alternatives and sustaining pro-climate behaviour.

References: Page 429

Improving Scientific Policy Advice with Respect to Responsible Innovation of Energy Systems

Bert Droste-Franke

Abstract

Results from an interdisciplinary EA project group providing recommendations for improving policy advice are discussed with respect to their contribution to responsible research and innovation (RRI) in the energy area. Starting from the general notion of RRI, the respective requirements for scientific policy advice are derived. The concept of robustness as a basic aim of energy system development is introduced before the general requirements of an appropriate scientific policy advice are analysed. Furthermore, practical implications of, for example, the way of dealing with uncertainties and the need to keep the option space large and not to narrow it down again until preparations for policy decisions are made. In addition, two supporting practical instruments are presented, namely the ethical matrix and specifically derived characterisation schemes of studies. In conclusion, the proposed improvements of scientific policy advice and their importance for an energy transition are discussed as one element for implementing RRI.

The Project

The suggested results on improving scientific policy advice in the energy area with respect to responsible research and innovation that are discussed here were elaborated in the context of the interdisciplinary project “Secure energy supply – New challenges for the analysis of future energy systems with regard to policy advice” carried out by the EA European Academy and funded by the German Aerospace Center (DLR). In the project the praxis of energy system analyses was specifically reviewed from the perspectives of the theory of science, ethics, technology assessment, econometrics, energy economics, and political science. This broad perspective resulted in a wide-ranging set of results, providing insights into the needs for and the general potentials and limits of the analysis of future energy systems as well as the specific challenges to meeting these needs with respect to the provision of policy advice on this topic. The project resulted in recommendations regarding the major aims of the analyses of energy systems, specifically on how to deal with uncertainty, on practical implications for the design of energy system studies and on extending the range of perspectives beyond purely techno-economic analyses (see Droste-Franke et al. 2015). Many features were revealed which could contribute to employing responsible research and innovation to improve policy advice.

Policy Advice in the Light of RRI

One of the most discussed and used definitions of RR I was provided by von Schomberg (2011). As my main intention here is to identify links between recommendations for improved policy advice and the use of RRI, I employ his definition without further considering the details of other approaches: "Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)" (von Schomberg 2013)

Further relevant issues for RRI which are of interest here are (von Schomberg 2013):

- "Products be evaluated and designed with a view to their normative anchor points…"
- "A multidisciplinary approach with the involvement of stakeholders and other interested parties."
- "Implementation is enabled by five mechanisms: technology assessment and foresight, application of the precautionary principle, normative/ethical principles to design technology, innovation governance and stakeholder involvement and public engagement."

Policy advice in such a process thus needs to support the transparency of the process. Societal actors and innovators as well as other interested parties should be involved in an "interactive process". Aspects of "(ethical) acceptability, sustainability and social desirability" should be considered, and products should be evaluated and designed considering their "normative anchor points". The call for "technology assessment and foresight" as one mechanism explicitly shows that the core elements of system analyses are needed.

We will see in the following that all these aspects are also important for achieving desirable long-term viable solutions for the design of complicated or even complex systems, such as the energy supply system.

Robustness: Challenges to Policy Decisions and Policy Advice

Following Droste-Franke et al. (2015), making responsible policy decisions means to take actions which contribute to the aim of society to achieve desirable (long-term viable) solutions. Such solutions need to be as stable as possible to withstand adverse impacts from the outside ((technical) robustness) and flexible enough to be able to take advantage of unexpected fortunate developments (opportuneness). Furthermore, they should be acceptable within a wide range of diverse interests and value commitments (social robustness). Overall, these requirements can be subsumed as the demand for robust decisions.

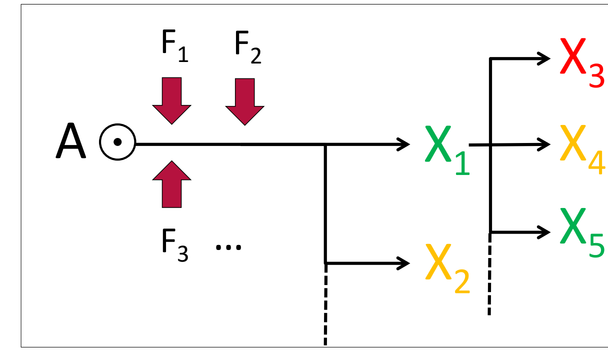


Figure 12: Simplified picture of the consequences of an action A, with the framework conditions F_i and the impacts X_i

In order to reach such robust decisions, knowledge is needed about the major consequences of options for action. A simplified model of actions and their consequences shows the respective requirements of decision-making support (see Figure 12). An action A, if taken, leads to changes in circumstances. These changes are represented here by the concrete impacts X_1 to X_5. Some of these consequences may be desired (green), some not (red) and some may be of uncertain interest (yellow). In order to ensure that the impact X_1 caused by the action A equals the anticipated aim of the action, the action has to be performed in a sufficient manner, taking into account all the relevant framework conditions F_i. Under changed framework conditions, a different action may be required to realise X_1 successfully and a different set of impacts X_i may result, respectively. Performing successful actions in this sense requires that the real impacts of an action can be sufficiently anticipated in advance. Thus, when taking an action, the influence of the framework conditions on the resulting circumstances needs to be sufficiently known beforehand.

Specific policy advice is needed to provide valuable and applicable information on what solutions exist and on how these could be implemented in a concrete situation. Especially with respect to complicated systems, system analyses which are concerned with describing regular correlations between circumstances are of major interest. They should be provided as reliable statements about the likely success and the impacts of an action. More specifically, such advice needs to be invariant to fluctuating or unknown causal factors and factual conditions (epistemically robust) and invariant with respect to a large range of interests and value commitments (socially robust). In order to meet these requirements, analyses of regular correlations (system analyses) should meet certain prerequisites:

- The best available knowledge needs to be considered including
  - all the relevant knowledge of technical, professional and scientific experts (particularly foresight and epistemic penetration required),
  - all the relevant local, experience-based knowledge.

- Analyses should concentrate on decisive issues and correlations. Considering the uncertainties of future events, it needs to be assessed if fine details in the components provide any additional value.
- The analyses need to be transparent in order to reveal the argument and should ideally support meta-analyses to be able to combine statements from various studies for a certain purpose.
- Uncertainties regarding assumptions should be discussed and considered in a way that a wide range of results is provided, exploring the option space as far as possible.
- The option space can be narrowed down by considering the interests and value commitments of the society on all relevant levels, ideally via participatory elements.
- Such an analysis can provide a good basis for decision making. However, political decisions require normative valuation and, therefore, must not be made by the experts. Decision makers need to be prepared to face complex decision-making situations which should be adequately presented by the experts.

Practical Instruments for the Improved Robustness of Policy Advice on Energy Issues

Two instruments which can be employed to improve the robustness of policy advice in the above sense will be exemplarily presented here for the energy area: the ethical matrix which allows ethical values to be considered in concrete decision contexts and standardised data sheets to be provided for studies.

The ethical matrix is constructed in a way that its use ideally reveals societal values on the basis of commonly accepted ethical principles and provides structured, issue-related discussions of consequences of actions. It can be used in participatory settings. As a first step in the application, the main actors in the area being analysed need to be identified and considered for the matrix. The consequences of specific alternatives for the actors will be displayed in the rows of the matrix. Analysing them requires expertise about the relevance of the consequences for the actors and provides a possibility for participatory elements in the analysis. Furthermore, ethical principles should be defined or chosen in a way that they are commonly acceptable to the persons involved in the valuation procedure. These could be general ethical principles like harm, beneficence, freedom/autonomy (option for action) and dignity/justice/fairness (limits of action) or other principles adapted to the specific decision-making situation. In the ethical matrix such principles are printed as column headings. Each entry in the matrix then represents a respective consequence. In the evaluation, a note can be made for each consequence as to whether it leads to a violation of the specified norms (expressed as minus signs) or are in accordance with them (expressed as plus signs). The final evaluation ideally requires a moral judgement on the consequences indicated by using the matrix. The issues on the matrix are ideally analysed with participatory elements. The matrix could, for example, be used in ethics commissions.

Standardised data sheets for studies could provide transparency facilitating the interpretation of a study's results. These would ideally include:

- Basic issues: name of study, year of publication, authors, institution, customer
- Aim of the study and the calculation method
- Spatial coverage/resolution
- Temporal coverage/resolution
- Extent to which perspectives and model elements are considered (e.g., technologies)
- Important assumptions

The extent to which perspectives and model elements are taken into consideration could be provided by using the "systems-web approach" developed in Droste-Franke et al. (2015). Examples for the usage of the approach can be seen in Figure 13. Schlesinger et al. (2010) and Nitsch et al. (2010) are two studies which were carried out in the context of the German energy concept in 2010. The two studies have different interdisciplinary foci. While the technical system is shown in good detail in both studies, the first study is much more detailed regarding economics, while the focus of the second stronger on aspects of natural sciences. A closer view shows that the good technical focus, however, also includes different foci. While Schlesinger et al. (2010) concentrate on conventional conversion and only take options regarding electrical grids and storage into consideration to a small extent (parameters assumed) and controllable consumption not at all, Nitsch et al. (2010) focus on renewable conversion, but also include detailed consideration of all the other options in parts of the overall structure, scoring 3: "part of structure detailed".

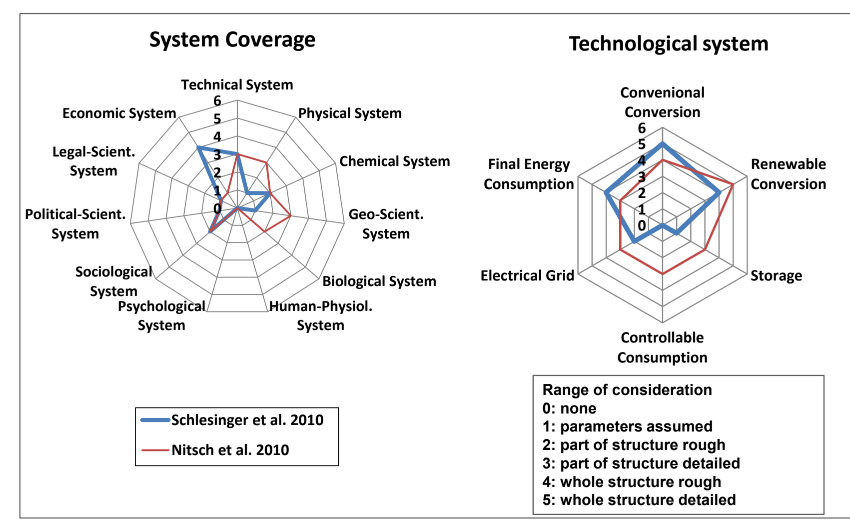


Figure 13: Characterisation of major studies in the context of formulating the German energy concept in 2010, applying the systems-web approach

A more detailed analysis of some further studies with respect to energy storage demand shows that the extent to which individual technology options are considered varies significantly between studies and that import/export is hardly taken into account in studies concentrating on Germany (see Figure 14). By trying to assess energy storage need and balancing demand from the studies, missing details in import/export reveal as major obstacles to derive meaningful values (Droste-Franke 2015).

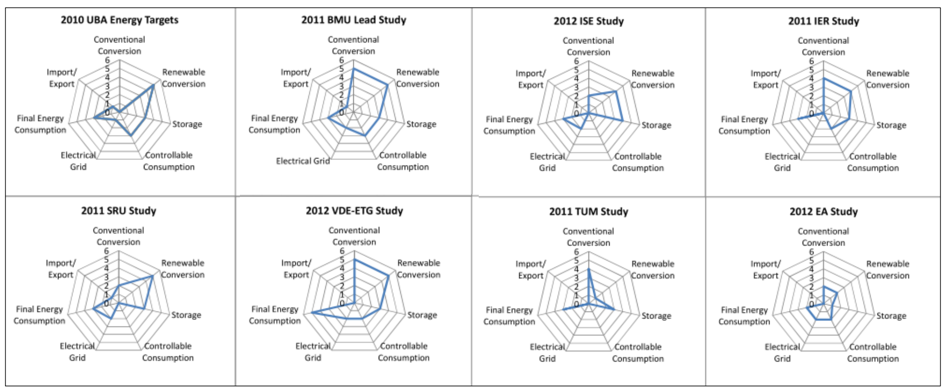


Figure 14: Variations in the extent to which technologies are considered in various studies concerned with energy system analyses for Germany (source: Droste-Franke et al. 2015)

Conclusions

With regard to the prerequisites for policy advice, I have shown that, following the RRI approach sketched by von Schomberg (2010) and the approach to robustness developed in Droste-Franke et al. (2015), central elements of RRI are met when the recommendations drawn to realise robust policy advice are followed, namely that desirable solutions need to be technically robust and flexible, as well as socially robust. The respective policy advice must analyse the option space sufficiently (epistemic robustness) and include mechanisms for selecting acceptable solutions from the option space (social robustness). Participatory elements can be included by using the ethical matrix roughly introduced here, which can serve to structure the discussion and evaluation with respect to basic ethical principles as “normative anchor points” in a transparent manner. Furthermore, the proposed data sheet for characterising studies following the systems-web approach can reveal critical characteristics of studies and differences between them and, thus, provide increased transparency. One way to introduce such elements and to proceed in the direction of more responsible or robust policy advice with regard to the energy system could be to introduce a code of conduct.

References: Page 429

Institutional Development and Responsible Innovation in the Transformation of the German Electricity System

Gerhard Fuchs

Abstract

The energy transition in Germany was initially advanced by local niche experiments. These early attempts were spirited by an ecological consciousness that aimed at developing alternatives to the incumbent regime of electricity generation, mainly nuclear energy. The chapter will deal with the question whether these initiatives can be interpreted as being instances of an attempt to realize the potential of responsible research and innovation (RRI).

Introduction

The concept of responsible research and innovation constitutes the most recent attempt to steer innovation activities in a socially desirable direction. Insofar it stands in a tradition of political efforts and scientific thinking about society, technology, and innovation. Technology assessment as a concept developed in the 1960s has gone through various stages of development. Discussions about the social and environmental compatibility of technological and overall innovation activities still take place and have found various forms of institutionalization but their overall importance and effect on ongoing activities is a matter of debate. Concepts like constructive technology assessment or various strands of participatory technology development have been experimented with, while public deliberation mechanisms, social foresight exercises, labeling, corporate activity aimed at developing and maintaining relations with communities, labor, and ecological stakeholders, actions to promote sustainability etc. can be detected, but have also not found any lasting impact in the way overall innovation activities are conducted. “….the practices ... are missing” as noted by Randles (2012: 176). This does not mean to say that technology developments and innovation activities have not changed. In fact, they have changed significantly and are increasingly being monitored by the public. Nico Stehr (2000) talks about the moralization of markets, meaning that society and civil actors have raised more and more demands on organizations about the way they manufacture their products and even certain qualities of the products and services they deliver. This demonstrates that new demands emanating from the public and partially subsequently sanctioned by the state and its regulations are important drivers for socially responsible innovation. As such, responsible research and innovation as a concept will be of significance if (and only if) it can link up and even mirror demands voiced by civil society actors.

This is an important issue since it is not to be expected that organizations or politicians change established and successful routines if not forced to. The concept of RRI hints at behavior that breaks routines, a new level of reflexivity introduced into innovation activities and a new level of activity that aims especially at including nonroutine elements, i.e., considerations that are not of immediate concern to the organization that drives these processes but to organizations in the surrounding environment.

This chapter will discuss the activities of civil society actors in bringing about a transformation of the German system of generating electricity and the resistance these actors have to cope with. It will attempt to demonstrate that they seek a socially responsive transformation.

The Creation of Niches

Since the 1980s, isolated attempts to develop new options for generating electricity have come into existence. These initiatives cannot be understood without taking into consideration the strong and sometimes violent resistance to nuclear energy in Germany. A negative attitude towards nuclear energy became more widespread after the Chernobyl accident when bigger parts of the German population as well as the Green and the Social Democratic Party began to oppose it. The different renewables (wind, solar, biomass) followed different trajectories, partly dependent on the characteristics of the technology. There was clearly a difference between the more low-tech application of wind power, the hands-on approach towards biomass, and the more science-oriented development of photovoltaics (PV). For reasons of lack of space, let us just look at the example of photovoltaics.

Although until well into this century the official research organizations in Germany did not recognize photovoltaics as an area worthy of funding, specialized photovoltaics departments and research institutes had been created in the 1980s, like the Fraunhofer Institut für Solare Energiesysteme in Freiburg (in 1982; Fraunhofer Institute for Solar Energy Systems), the Zentrum für Sonnenenergie- und Wasserstoff-Forschung in Stuttgart/Ulm (in 1988; Centre for Solar Energy and Hydrogen Research Baden-Württemberg); there are also specialized physics departments, for example at the Carl von Ossietzky University in Oldenburg. These institutions can be seen as typical examples of how the formation of the photovoltaics advocacy coalition depended on highly committed individual actors. They were influenced by the experiences of early antinuclear power activists, who were criticized for their lack of reasonable alternatives for providing energy. The formation of research groups and departments dedicated to the development of alternatives to nuclear power became the first strategic step towards the formation of an advocacy coalition supporting

photovoltaics. Furthermore, the creation of specialized departments and institutes attracted environmentally committed scientists, and later local networks of environmentalists and researchers emerged. This was the case in Freiburg, for example, where the Fraunhofer Institut für Solare Energiesysteme merged with a vivid environmental scene that positively influenced network activities and enabled local strategies of niche management.

Throughout the 1990s, industrial (solar) associations whose goal was to improve and enhance political support for the infant technology and its commercialization were gradually established. Additionally, (local) groups and associations, like the Aachen Solarverein, Eurosolar and Förderverein Solarenergie were founded and discussed the suitability of political instruments; they were also developing blue prints for regulatory instruments and tried to build up political momentum. They were joined by local politicians that strongly favored the idea of renewable energies and that opted for a more decentralized energy system. For them, grid-connected photovoltaic applications met both of these aims. Thus it was a coalition of local politicians, the Green party, researchers, environmental societies, and business associations that both started experiments on a local level and tried to influence the federal government to improve and enhance its innovation policy toward photovoltaics.

In the early 1990s small support programs were created by the Federal Government, which had some positive effects on wind development but did little for photovoltaics. Once these programs ran out and no successor programs were initiated, strategic niche management appeared on the local level: protagonists of the solar scene were successful in implementing local feed-in-laws, e.g., inspired by the Aachen Solarverein. In contrast to the provisional first federal law, which had only regulated the remuneration of photovoltaic power at arm's length, the concept of the Aachen Solarverein provided cost-covering prices. The development of a policy instrument that aimed at convincing users to purchase photovoltaics for its return on investment can be interpreted as a change in secondary aspects. Still adhering to its policy core, the photovoltaics coalition had learned new strategies to achieve its goal. Thus the new mechanism opened the way for the wider diffusion of photovoltaics, making it not only attractive to ideological environmentalists as potential users, but also an interesting financial option for nonideological customers as well (i.e., going beyond the initial advocacy coalition).

If we would draw a regime map of the system of electricity generation in Germany in the 1980s and 1990s, we would find the area dominated by public utilities using fossil fuel power plants and nuclear energy with a few spots of resistance scattered largely unconnected across the country.

The Case of W.[1]

The origins of energy-related activities in this small community in the southwest of Germany are linked to a citizen initiative, which formed in the late 1080s after plans had been announced for the construction of a large composting plant. The citizen initiative opposing the construction of this plant eventually turned into a local party and in 1989 managed to win four of the eleven seats in the village council. Since alternatives to the composting plant had to be found, the citizen initiative began collecting information on biogas and biomass. In 1990 the citizen initiative turned local party was able to win the position of mayor. The central issue in the electoral campaign was the composting plant. The mayor established contact to a renowned expert in the field of bioenergy, who quite accidentally lived in the same neighborhood. These two persons closely cooperated in developing the initial concepts for a biogas installation. A core group formed out of this cooperation consisting of "respected" persons from the community and was given broad support by the community. This understandably led to a certain uneasiness among the political incumbents who had lost elections over this issue (up to 2012 the conservative party in the state of Baden-Württemberg was unchallenged in its leading political role). The core group consisted of the mayor, the biogas expert, the manager of a local company engaged in photovoltaics, and a representative of a local bank.

Once the plans had been approved, financial support from the EU and the state government was secured. At this point, resistance in the community once again arose, and the creation of a new citizen initiative—this time against the biogas installation—was debated, but the mayor and his core group withstood this opposition especially by promoting openness, holding regularly meetings with the population, and bringing in people from the outside who stressed the lighthouse character of the plans. Later on, farmers again voiced their protest against the installation. All this opposition activity, however, lacked a steady organization, and people grouped around single issues for only a short period of time. The opponents furthermore did not link up to statewide or national organizations opposed to plans for renewable energy sources (RES).

To run the installation, a dedicated organization was eventually founded, which consisted of 60 partners (e.g., farmers, equipment producers, and interested citizens). Due to problems related to the complexity of the installation, the project, however, soon merged with other "green" projects in the area, which then were all managed by a common board. The biogas installation in W. was the first of its kind in Germany with an official permit to ferment food remains. In spite of the fact that many observers call this installation the mother of all other similar installations in Germany, it was shut down in 2009. At this time the installation provided electricity for 20% of all the homes in the community. The community, however, was not willing to pay for modernization of the installation since new opposition had formed. This opposition was mainly spurred by the growth of the installation and ensuing problems (e.g., traffic). In addition, three meeting halls had been built to accommodate the interest of the general public in this model community and for holding meetings of biogas specialists and biogas associations, and exhibitions.

Nevertheless, at this time the community was no longer experimenting only with biogas. Photovoltaic installations had spread in the community with the support of the aforementioned local company. In 2011 the community became the leading solar community in the state of Baden-Württemberg. In spite of the fact that larger photovoltaic installations

were successfully opposed by local farmers, two windmills proposed by groups of citizens were approved. The increasing production of energy proved difficult to manage, however. Up to 2011 a local network operator was responsible for the traffic, for the continuous provision of energy locally, and for the export of unneeded energy. Given the increasingly complex nature of the task and the growing regulatory requirements for decentralized installations, the operator was forced to sell out to the regional oligopolist ENBW (one of the four big utilities in Germany). Whether this will have any effects on the further development of the energy-related initiatives in this community remains to be seen. In spite of the constant struggles and resistance to individual projects, a representative survey among the inhabitants of the community revealed that 88% of the population supported the overall course of development within the community, and 87% claimed to be in favor of a further development of renewable energy.

W. is a prime example of a community jumping early onto the idea of renewable energy. The idea was driven forward by skilled individuals, who through determined coalition building with various factions of the population achieved broad support within an environment that did not seem to be conducive to experiments: conservative and rural. The example also shows that the choice of technologies was more or less opportunistic. The determining factor was not technology development and the specific implementation as such, but the availability of different types of technology supported by local expertise. Unlike in other communities, opposition to individual projects such as a solar farm or the modernization of the biogas installation did not derail the community from its path towards becoming 100% renewable. Opposition - as in many other cases - came from farmers, who feared that increasing property prices would damage their core business, and from the population when it got the impression that things got too big and thus were damaging the promise made by the project initiators to remain small and close to home.

	Ecological logic	**Economic logic**
Framing	Renewables as an alternative to nuclear energy	Renewables as an opportunity for (re) vitalizing local economic activities
Relationship with related fields	Confrontation with incumbent politicians and industry	Cooperation with incumbent politicians and calculated conflict with energy providers
Dominant organizational principle	Common good	Corporate good
Mobilization	Concerned citizens and scientists	Professional organization
Member orientation	Community	Service orientation
Definition of success	New decentralized architectures of electricity generation	Profit, economic viability

Table 12: Two types of local initiatives

Conclusion

Responsible research and Innovation is not just a new concept developed by scientists and political advisors. A look at the history of the German debate on the transformation of the system of electricity generation shows that it links up to the expectations of real people which want to bring about change. This is change understood in a way to give up established routines and replace them by new social practices, in the development of which concerned citizens have a say. The empirical cases also show that this is no easy feat, that various obstacles have to be dealt with, and that the final outcome is uncertain. The cases also demonstrate, however, the importance of institutional safeguards for such a process.

References: Page 430

Diverging Frames under High Voltage

On the Conflict over the German Electricity Grid Extension

Gotje Bossen and Mario Neukirch

Abstract

The plan to extend the transmission grids in Germany leads to massive conflicts. Since 2004, about 500 kilometers of new transmission lines have been installed. More than ten times the amount is meant to be installed by 2022 (including upgrades of existing power lines). The coalitions of advocates argue that the extension is needed in order to allow the implementation of the energy transition. Affected citizens – often joined by local and regional state governments – demand modifications (e.g. underground cable sections). In some regions they do oppose the construction plans in general. This study analyses the conflicts from a constructivist perspective and shows that the coalitions have a different – sometimes even opposing – view on the grid extension. To understand the core issues surrounding the conflicts, the expectations of the coalitions are identified and sorted by using frame analyses. Taking the actor constellations and the controversies into account renders more transparency to the matter. The study calls for a more genuine participation approach in socio-technical projects.

Concept

In order to analyze the existing conflicts, the underlying expectations of the actor coalitions are identified. Subsequently, the expectations are sorted into frames related to energy. In this way the opposing emphasis of the expectations becomes apparent. We make use of some aspects of the theory of strategic action fields (Fligstein/McAdam 2011).

The incumbent coalition consists of transmission grid operators (TSO), owners of large power stations, the German government (particularly the Federal Ministry for Economic Affairs and Energy and the Bundesnetzagentur) as well as the German Energy Agency (dena) and associations of the established energy industry like the German Association of Energy and Water Industries (BDEW) and the Verband der Industriellen Energie- und Kraftwirtschaft (VIK – German Association of the Energy and Power Industry) occupy a dominant position in the field and have a major influence on the policy process. The challenger coalition has fewer resources to influence and acts from weaker positions. All actors try to achieve a better field-position through strategic activity.

While the expectations on the challenger side are full of doubts and characterized by the fear of negative consequences, the incumbents often argue with forecasts on the expected costs of the expansion plans as well as the necessity of the new lines for the energy transition. Both coalitions use media channels such as newspapers, web presence and print media in order to share their expectations. Spreading and sharing expectations allows other actors to join the coalitions if they agree to the coalition's common expectations. On the long run, the opposing coalitions will not be able to ignore the other coalition's expectations as widely shared expectations gain momentum, which requires all actors to take a stand on these expectations (Borup et al. 2006). Widely shared expectations strengthen the frame in which these expectations are allocated. Thus, by using the framing analysis the expectations can be structured and ranked.

The framing analysis can be traced back to the sociologist Erving Goffman. He assumed that individuals actively classify, sort and interpret their experiences. Through this, individuals are able to give meaning to particular events (Goffman 1974, 21). Frames are schemata of interpretation and are used to analyze the shared interpretation of actions of the coalitions. Frames we found in the grid extension debate are among other Efficiency, Security of Supply, Energy Transition, Participation and Protection of Health, Nature and Landscapes.

The framing analysis also shows to what extent coalitions refer to the expectations of the opposing coalition. In cases where a frame becomes visible in a coalition which usually did not refer to this respective frame, we speak of frame adoption (FA).

Challengers and Incumbents: Diverging Frames

The following description is based on the evaluation of about 500 documents like press releases, statements, open letters and articles in regional newspapers. To be able to assign a frame to an entire coalition it is necessary that the actors of this coalition repeatedly express the respective frame. Both coalitions are present in the same structure in other conflicts related to the energy sector (e.g. fracking, CCS, protest around nuclear power). On the incumbents' side, the frames Efficiency and Security of Supply are usually dominant (Hennicke/Müller 2006), while the challenger coalition mainly focusses on the frames Protection of Nature and Landscapes, Energy Transition, Participation and Health Protection. To a certain extent, frames of the opposing coalition are adopted. Since these adopted frames are not in line with the coalitions' "core beliefs", we consider the adoption serves as a strategic improvement of one's own position. Usually, frame adoptions go along with modifications of the original frames.

The following tables summarize the frames of both coalitions. Expectedly, for the incumbent coalition, the classic frames Efficiency and Security of Supply play a vital role (Table 13). Energy Transition and Participation as frame adoptions are important as well. In very few cases, the incumbents consider the frames Protection of Nature and Landscapes and Health Protection. In Table 14, the frames are broken down to the individual actors of the incumbent coalition. For interest groups, the frame Participation seems to be of less relevance than for the TSO. The German Association of Energy and Water Industries (BDEW), for instance, refers only in two out of ten sources to Participation.

Security of Supply	Efficiency	Energy Transition (FA)	Partici-pation (FA)	Protection of Nature (FA)	Health Protection (FA)
35	24	47	40	5	1

Table 13: Incumbent frames

Actor	Total number of analyzed sources	Security of Supply	Efficiency	Energy Transition (FA)	Participation (FA)	Protection of Nature (FA)	Health Protection (FA)
Tennet	28	12	4	11	16	3	-
50 Hertz	11	3	4	5	3	1	1
Amprion	3	-	-	-	3	-	-
EnBW	2	2	-	1	2	-	-
dena	7	4	3	6	2	-	-
BDEW	10	4	4	6	2	-	-
VIK	3	2	2	2	-	-	-
Bundesnetz-agentur	13	3	3	8	8	1	-
Federal Government	2	1	1	2	-	-	-
BMWi	4	-	2	3	3	-	-
BMU	2	-	-	1	2	-	-

Table 14: Actors of the incumbent coalition

The most important frame of the challenger coalition is Participation (Table 15). Other frames are Health Protection, Energy Transition as well as Protection of Nature and Landscapes. Also an adoption of the frame Efficiency can be observed. In Table 16 the existing frames are assigned to the various protest regions. While the frame Protection of Nature dominates the conflict regarding the EnLAG 3 project (Brandenburg), it does not possess the same relevance for most other regions. We emphasize the role of the Energy Transition frame for the protests against EnLAG 4 and the HVDC project from Saxony-Anhalt via Thuringia to Bavaria. The frame Participation is present in all regions (Table 16), while Security of Supply does not play a great role on the challengers' side.

Health Protection	Partici-pation	Energy Transition	Protection of Nature and Landscapes	Security of Supply (FA)	Efficiency (FA)
18	44	17	14	5	14

Table 15: Challenger frames

Project	Total number of analyzed sources	Health Protection	Participation	Energy Transition	Protection of Nature and Landscapes	Security of Supply (FA)	Efficiency (FA)
EnLAG 1	10	5	5	2	-	1	1
EnLAG 2	6	-	6	2	1	-	-
EnLAG 3	9	4	8	(1)	4	1	3
EnLAG 4	8	-	7	5	2	-	2
EnLAG 5	6	3	4	-	-	-	-
EnLAG 6	5	3	4	-	2	2	4
HVDC A	3	-	3	-	-	-	-
HVDC C	4	1	2	1	1	-	1
HVDC D	7	2	5	5	2	1	2

Table 16: Frames in the protest regions

Interpretation

What do the frames tell us about the actors' objectives? First, the two coalitions prioritize different frames. Second, actors use the same frame but have different expectations connected to this frame (FAs).

Challengers' Frames

Health Protection
The protesters view the installation of power lines as a threat to health. Repeatedly they point out the risks of leukemia. One of their claims is that the regulatory limits in Germany should be adapted to international standards. In the City of Quickborn, for instance, an overhead line was planned across a school yard which led to massive protests.

Participation
Generally, the challengers feel they are badly informed about the extension plans. They have the impression that agreements were literally made above their heads. In sum, this frame shows that transparency and a greater say regarding the changes to the challengers' surroundings are considered to be missing.

Energy Transition
This topic is not equally found across regions. There is also no common definition of the term in the context of grid extension. Some challengers highlight its importance for a better grid integration of RE. However, citizens are not willing to make unlimited sacrifices for this purpose. The energy transition itself is accepted, but the interests of the general public should be more acknowledged. To some extent, it is questioned whether the grid extension is really necessary for the energy transition. Many actors do not agree with certain projects. They criticize negative effects on climate policy and oppose new power lines used for transmitting power from coal plants.

Protection of Nature and Landscapes
This frame consists of two aspects: Protection of Nature and Protection of Landscapes. Protection of Nature refers to the conservation of natural sources and certain animals, especially birds. In contrast, Protection of Landscapes is more about cultural landscapes: local recreation and tourist areas as well as the fear of the familiar surroundings being changed. Sometimes – consciously or not – challengers are referring to both aspects.

Efficiency (FA)
Usually, protesters refer to efficiency in a negative way: They demand a change of the balance between efficiency and aspects like nature and health protection in favor of the latter. Generally, the incumbents have the power of interpretation over the meaning of Efficiency. But in the case of grid extension protests, the challenger coalition offers an alternative understanding of efficiency as well:

- TSOs wish to install new lines because there is a guaranteed return of nine percent on grid investments. This quest for profits should be stopped.
- Underground cables are cheaper due to shorter planning periods and lower social costs.
- If the costs for new power lines are included, a decentralized energy transition would be less expensive than the status quo (planned over-capacities of RE in Northern Germany).

Security of Supply (FA)
The incumbent utilities are usually considered to be the keepers of the security of supply. Thus, their authority is largely legitimated. Only in a few cases (Table 15), attempts to reframe and occupy the predominant understanding of this term are dared (e.g. to claim that underground cables are more suitable to secure the supply than overhead lines because of their higher resilience against extreme weather events).

Frames of the Incumbent Coalition

Security of Supply
This traditional frame can often be detected in the context of the network expansion. To ensure the demand of the industrial and private sector is part of the self-image of large utilities. Basic changes to the energy system (e. g. nuclear phase-out and growing capacities of volatile power) are often perceived as a threat to the security of supply. In their view, only the massive expansion of the 380kV (overhead line) transmission grid as a proven technology would be a solution. On the other hand, they are very skeptical about the (unproven) underground cable technology. Therefore, smaller-scale pilot projects are deemed necessary at the moment.

Efficiency
Together with Security of Supply, this frame constitutes the traditional core belief system of the incumbent coalition. Regarding the extension, Efficiency is relevant in two ways: First, the demand for a more decentralized supply structure as an alternative to grid extension is rejected because of cost reasons. Second, the cost argument is used to legitimate the overhead line technology and reject the demand for underground cables. In a "purified" version, the TSOs pass the buck to the consumers: "We are not for or against underground cables! But it must be clear that the additional costs may be shifted to consumers." In this case not only the entrepreneurial self-interest is highlighted, the TSOs also mainly aim at a reduction of the general popularity of the underground cable solutions.

Energy Transition (FA)
The term as it is used in energy policy is ambiguous. It dates back to the 1970/80s and has long been regarded as a political category to discredit the established structures and their destructive potential for human health and environment. Later, the confrontation has weakened and a mere technical conversion to Renewable Energies was considered to be the essence of an energy transition.

The TSOs often use the term to justify the need for new power lines. For this, they refer to an excess of wind power in Northern Germany combined with a shortage of capacities in the South which was mainly triggered by the nuclear phase-out. Paradigmatic for this understanding is the "grid study" by dena from 2005 entitled "Technical and Economic Aspects of the Grid Integration of Wind Energy in Germany and Offshore by 2020". For the first time, the need for a massive grid extension was placed on the political agenda. The focus on "transporting wind power from the coast to the South of Germany" as the main reason for the proclaimed necessity of grid extension is the most common adaption[1] of this frame by the incumbent coalition. More adaptions are:

- "System integration" of Renewable Energies by grid extension.
- Link the development of new wind and solar power capacities to the pace of the grid extension.
- Put pressure on citizens' initiatives: "To advocate for energy transitions means acceptance of grid extension!"
- Connect the frames Energy Transition and Efficiency by criticizing the high costs of the energy transition – especially if grid capacities are insufficient.

To a considerable extent, this FA consists of strategies to slow down the speed of the transition or to discredit the protests.

Participation (FA)
The German energy system with its multibillion-dollar investments in centralized infrastructures was never known for its transparency (e.g. Hennicke/Müller 2006). Critical decisions like the introduction of nuclear power technology were usually made behind closed doors and pushed through with force if necessary. Surprisingly, the frame Participation could be identified in 40 of 89 evaluated statements given by the incumbent coalition. Until 2011, the TSOs' understanding of participation was limited to maintain the standards which are guaranteed in planning law anyway. Since then, participation has become very important, especially where TSOs try to reach citizens and wish to gain visibility. In the conflict areas, contact offices were established and information events were held. Topics are underground cables, potential health threats by electromagnetic waves and details of the route. The projects as such may not be questioned. However, the instrumental relationship to participation becomes apparent in numerous statements. The main reason is to de-escalate the conflict: "We need participation in order to improve acceptance."

Protection of Health, Nature and Landscapes (FA)
These issues are rarely addressed by the incumbents. Nevertheless, they are taken seriously. Thus, for example, Tennet and 50 Hertz signed the "European Grid Declaration – On Electricity Network Development and Nature Conservation in Europe". Concerning health threats, the TSOs usually point out that there is no scientific evidence which proves the dangers of electromagnetic waves as long as certain limits are kept.

Conclusion

Both coalitions share a canon of frames, which clearly corresponds to their positions within the conflict. The challengers especially criticize a lack of participation as well as the missing protection of health, nature and landscapes. Moreover, they propose an alternative understanding of efficiency.

The incumbents have transferred their traditional interpretation of the frames Efficiency and Security of Supply into the context of grid extension. This is mirrored in their pleas for a massive extension of the transmission grid based on well-proven overhead line technology. Taking into consideration that the protests could not be discouraged by restrictive policies or by discrediting public statements, the majority of the incumbents changed their communication strategy.

However, the adoption of the frame Participation, too, – which especially shows in embracement and involvement strategies – was hardly successful. Participation offers were rejected in many cases, and public discussion meetings – organized by the TSOs or the Bundesnetzagentur – were seen as "alibi events" in several cases. The question of how far conflicts in areas without larger escalation could be reduced or even completely prevented by a friendlier and more respectful behavior was not part of our study. On the other hand, the adoption of the Energy Transition frame was more successful: In this case, the incumbent coalition managed to enforce the view that grid extension would be required to continue the transition to Renewable Energies.

The framing analysis shows that – other than the problem of individual concern – solutions to the conflict are complicated by the diverging expectations. The gap between both coalitions becomes especially evident when they even disagree while apparently talking about the same thing.

Of course the mere analysis of the conflict cannot lead to a settlement of the dispute. Nevertheless, our results might help to create a more holistic picture and improve the transparency of this complex field of action and its dynamics. In the best case, it enables more precise assessments for the legislative developments and compromises between the conflicting parties.

Grid extension should become an interactive and truly participatory process, in which the society as a whole deals with the basic controversies addressed. New or upgraded power lines should not be built if their main purpose is to restore the profitability of coal power plants. For this purpose, some political commitments coupled with legislative steps referring to the coal sector are required (Neukirch 2015). Furthermore, the aim should be to achieve a new balance between the predominant economic view and the social costs of overhead power line technology.

References: Page 430

TECHNOLOGY ASSESSMENT IN HEALTHCARE PRACTICES

Articles from the PACITA 2015 Conference Sessions:

Advanced Genomics in Health Care?

Using Technology Assessment to Design a Step-by-Step Approach in EU Member States

Dirk Stemerding and André Krom

Abstract

In a PACITA Future Panel project we explored the challenges arising from the introduction of next-generation sequencing technologies in European health care. We concluded that a step-by-step approach is warranted in addressing these challenges. In this paper we discuss what this approach might entail at the national level of different EU member states.

Introduction

An important future challenge facing healthcare systems in Europe is how to deal with data and technologies provided by advanced genetic research and so-called ‘next-generation sequencing’ (NGS). DNA sequencing technologies are rapidly becoming cheaper and faster. The expectation is that this will enable detailed genetic risk profiling as the basis for targeted interventions, leading to health care practices that are more personalized, predictive, preventive, and consumer-driven.

However, there is a clear threat that premature technology and market-driven applications of NGS will inundate physicians and patients with meaningless or uninterpretable data. There is a wide gap between our ability to generate ‘more data for less money’ and our ability to understand them or validate their clinical utility. Political intervention is needed to guarantee that the use of genomic technologies in public health services does not lead to detrimental consequences.

Against this background, it was decided to take up ‘public health genomics’ (PHG) as a topic for one of the three technology assessment (TA) demonstration projects that have been carried out as part of the PACITA project.[1] Given the rapid scientific progress and many challenges for policy-making in the foreseeable future, an expert-based methodology – the Future Panel – was chosen. The central idea behind the Future Panel (FP) method is to connect the scientific and the political discourse in a new and constructive way. In general, the method is well-suited for far-reaching topics that require central political initiatives and action, and where there is a desire to act proactively.

The FP method has originally been developed and applied in a national context. In this case, we wanted to demonstrate the use of the FP method in a European context. Consequently, the FP was formed by parliamentarians from different European member states and the European Parliament. Although the aim of our project was to demonstrate the FP method as a specific parliamentary TA approach, it was also a methodological experiment, because the FP method had to be adapted to this cross-national context (Krom & Stemerding 2014).

As an example project the Future Panel on Public Health Genomics succeeded in contributing to the central aim of PACITA to induce mutual learning on how to perform parliamentary TA. As a methodological experiment the project did not fully meet its objective of connecting the scientific and political discourse on PHG in a new and constructive way. Through its broad approach, however, the project and its documented outcomes offer a useful starting point for more detailed policy-oriented evaluations of NGS applications in a diversity of health care practices on the national level. With this aim in mind, we brought together in a PACITA conference session speakers from the four organizing countries involved in the FP project – Germany, Lithuania, Portugal, and the Netherlands – and a speaker representing the EU level. In the following we first describe in some more detail our FP project and then discuss the different visions that were presented during our session on the prospects of and challenges for PHG at the national level.

The Future Panel Project

The Future Panel project on Public Health Genomics consisted of three stages which took place in a one and a half year time span. In the first stage the precise scope of the project was defined during a kick-off meeting involving the FP, which resulted in a list of policy issues that were identified as most relevant for further investigation. During the second and main stage of the project, taking a full year, policy issues and options for PHG were discussed and elaborated in different Expert Working Groups and in a Policy Options Workshop. The final stage was a Policy Hearing in which the Future Panel discussed the main outcomes of the project with invited experts (Almeida 2014).

The main target group of the project was the Future Panel, including one member of the European Parliament and three members of national parliaments (Denmark, Portugal, and Switzerland). The four members represented different parties on the political spectrum. The main role of the FP was to co-define a research and policy agenda at the start of the project and to discuss, during the final Policy Hearing, the issues and options articulated by the Expert Working Groups.

The task of the four Expert Working Groups was to produce twenty-page reviews of: (1) The state of human genome research and its prospects for future medical applications in PHG; (2) Issues of quality assessment relating to the clinical validity and utility of genome-based medical applications and practical experience in PHG; (3) The possible economic and structural effects of PHG on the public health system; and (4) The ethical, social and legal aspects of PHG (Expert Working Groups on Public Health Genomics 2013).

The combined analyses of these Expert Working Groups highlighted two major shifts connected to developments in PHG that challenge traditional boundaries in health care (Stemerding & Krom 2013). First, the introduction of NGS in health care systems challenges the boundary between research and clinical care. It entails complex data flows which create tensions between the needs of research and the needs of the individual, and raise a number of issues relating to infrastructural demands, data security and privacy, patient rights and professional responsibilities, and the potential feedback of (re)analyzed data. Secondly, the introduction of NGS in health care systems challenges the boundary between clinical care (particularly diagnostics) and screening. Both diagnostics and screening generate potentially large amounts of information about an individual's genome, and raise new and challenging issues concerning quality assessment and how to deal with unsolicited information that might result from these tests. As NGS finds further application in established and new practices of diagnostics and screening, these issues will arise in a variety of health care settings and have implications for the relations between all stakeholders, including researchers, health professionals, patients, regulators, and insurers. Thus it was concluded that the responsible introduction of NGS in the health care system requires an early dialogue in which these stakeholders are actively involved.

It was the ambition of the FP project to deal with the full scope of possible future applications of NGS, such as pre-implantation and prenatal genetic diagnostics, new-born and adult screening programmes. The time span of the project, however, did not allow for detailed discussions of options for policy intervention and regulation or of existing practices and regulatory stipulations for each of the fields of application. Also, a more in-depth analysis of the state of practice in the different countries involved was not possible.

The project did provide, however, relevant input for policies on PHG in terms of an overview of the state of affairs and policy options (Stemerding & Krom 2014). It succeeded in involving a broad range of European genomics experts as members of the Expert Working Groups. Thus, policy makers and practitioners from the countries involved were provided with the best available expert knowledge on genome-based information and technologies and could gain practical experience with TA as a practice of democratic and transparent knowledge-based policy consulting.

The complete interactive exercise of Expert Working Groups, Policy Options Workshop, and stakeholder consultation supported the notion that developments in PHG hold the promise to be beneficial for individuals and to promote public health. However, a crucial insight from this process is also that, given a range of uncertainties and ambiguities, the responsible introduction of NGS in health care systems will require a careful step-by-step approach involving a broad societal and political debate about the direction in which health care systems should develop (Future Panel on Public Health Genomics 2014).

Next Steps: Challenges on the National Level

Given this insight, our PACITA conference session on Advanced Genomics started from the idea that we should not see the future of PHG in terms of a 'road map' leading us in one particular direction, but rather in terms of complex and differentiated health care landscapes that may be affected by the emergence of NGS in a variety of ways. In this process new options will be created for diagnosis, treatment, screening, and prevention. Each of these options will raise different issues that have to be considered in a way that allows experts, stakeholders, and policy makers to gradually learn about and decide upon the future opportunities and societal impacts of PHG. Our session then focused on the question what this step-by-step approach would entail in the diverse health care landscapes of different EU member states. To discuss this question, we invited speakers from the four countries involved in our FP project and also asked for input from the European Commission (see table below). With our session we hoped to provide an opportunity (i) to develop a more fine-grained perspective on the introduction of NGS in specific national health care systems, and (ii) to further promote parliamentary TA assessment (in general and concerning NGS) at the national level.

Invited speakers in session "Advanced Genomics in Health Care?"
• Peter Propping, Institute of Human Genetics, University of Bonn, Germany
• Eugenijus Gefenas, Director Lithuanian Bioethics Committee, Lithuania
• Veronique Ruiz van Haperen, Health Council of the Netherlands
• João Lavinha, Human Genetics Department, National Institute of Health (INSA), Portugal
• Jaroslaw Waligóra, DG Health and Food Safety, European Commission

Table 17: Invited speakers in session "Advanced Genomics in Health Care?"

From the presentations it appeared that NGS has already been relatively strongly entrenched in the health care system of the Netherlands. It has been introduced in Dutch clinical genetics services and university medical centres as a tool to perform rapid, comprehensive diagnoses and to enhance the direction and speed of treatment. The areas of application include congenital disabilities and/or mental retardation, cardiomyopathies, and cancer. It is expected that NGS will become more and more used as a tool for cheap and rapid genome-wide sequencing, blurring boundaries between diagnosis, screening, and research. Questions raised by this development with regard to data quality, privacy, and consent have been put on the political agenda by the Health Council of the Netherlands in a recently published report (2015). The political and societal context of the health care landscape in the Netherlands also adds to the challenges and tensions observed. Dutch health care policy is keen on prevention, stimulating the general public to make informed choices about their health and opening the doors to routine health checks. On the other hand, with constantly rising health care costs, the ministry is also trying to curb innovation, considering very carefully whether everything that can be done should be done. In this field of force the Health Council has recommended the Minister of Health to organize and coordinate professional and public debate on the advisability of expanding the use of NGS in diagnosis and screening.

Germany and Portugal belong to the EU member states that have adopted legislation regulating the provision of genetic tests, inspired by the Council of Europe Additional Protocol concerning genetic testing. In Germany the Gene Diagnostics Act regulates genetic diagnostics for medical purposes. According to the law, informed consent is required and genetic testing of minors and handicapped persons is only allowed under restrictive conditions. Genetic screening should be offered only for treatable conditions. The results of genetic analysis are only available to the tested person and physician involved and biological samples have to be discarded after analysis. The current law does not apply to research and does not yet cover the new high-throughput sequencing technologies. In Germany, most diagnostic laboratories, in particular the private ones, do not feed genetic variants into public databases. However, making this knowledge available in biobanks to the genetic community would be in the public interest, since information about genetic variants and their phenotypic correlates could be of great help in advancing genetic research. These and other aspects relating to the future role of NGS in health care will require a reconsideration of the German law.

Similar observations can be made about Portugal and Lithuania. In Portugal the need is also felt to further develop and implement a health technology assessment policy and regulatory framework on all relevant issues relating to already available and foreseeable practices of NGS-based testing, including population and new-born screening initiatives. In Lithuania an active debate on the need for regulation of biobank activities has been going on for several years, focusing on an initiative to amend the existing law on biomedical research. This debate now seems to be converging into an agreement about legal provisions for broad individual consent in obtaining biological samples and personal data for public health biobanking purposes.

Conclusion

The aim of our session was to explore the introduction of NGS in national health care landscapes in terms of a step-by-step approach. In comparing the different national perspectives we do not only see different concerns, but also different approaches in the way these concerns are governed. In the Netherlands the Health Council and the government seem to rely primarily on mutual learning in the field, also including education and involvement of the public. In the other countries we see more emphasis on legal instruments in governing the use of genetic knowledge and technologies in health care. An interesting question arising from these differences is how to evaluate these different styles of governance from an innovation and a technology assessment perspective.

References: Page 430

Trust in Health Information Systems

Adequacy of Policy-Level Control and Beliefs about Personal Autonomy

Jodyn Platt, Peter Jacobson, Renee Anspach, Charles Friedman and Sharon Kardia

Abstract

Rapid and broad sharing of health information is a goal of large investments into electronic health record systems and "big data" research collaborations. Public trust in the governance and use of health information are key components in the sustainability of such systems as they continue to expand. This paper considers the question of how the public's confidence in the policy environment, their sense of personal autonomy, and individual trustor characteristics (e.g., knowledge, beliefs, demographic factors) are related to system trust. We present results of a nationally representative U.S. survey (n=1,100) and consider their policy implications. We conclude that policy makers should not let privacy overshadow factors that are of similar or greater concern for assuring trust. Resources to build trust would be well spent on engaging communication challenges and addressing perceived harms and the public's beliefs about deception, and articulating the potential personal and social benefits.

Background

Increasingly large and networked electronic health record systems, population biobanks, and 'big data' collaborations are rapidly expanding the depth and breadth of data sharing. Efforts at a global, multinational, and national scale bring together policy makers, health professionals, and other experts to negotiate governance- related issues such as data sharing, ownership of data, and privacy and security. Yet today's standards for sharing health information across institutions greatly exceed the public's understanding of how such integrated systems operate, thereby raising questions of trust. Large, complex systems can be breeding grounds of mistrust given their inaccessibility and the uncertainty they embody (Gefen, Karahanna and Straub 2003; Giddens 1991; Luhmann, 2000).

In this paper, we present results of a nationally representative U.S. survey that examined the relationship between trust in the organizations that have health information and share it (i.e., system trust) and beliefs about the policy environment that governs data sharing, an individual's sense of personal autonomy in the health system vis-à-vis their health information, and individual trustor characteristics that might shape system trust such as knowledge, experience, beliefs about deception and privacy, as well as psychosocial and demographic factors. The results of the survey are considered in terms of their implications for national and global policy.

Trust, policy environment and personal autonomy

Defined as a cognitive expectation or willingness to impart authority and accept vulnerability to another in fulfilling a given set of tasks, trust is of greatest importance under conditions of high risk or uncertainty. Without risk, trust is not necessary as there are no consequences to failing to fulfill the obligation in question. Trust plays a minimal role in transactions with known outcomes or no risk of loss (Hardin 2002). Policy environment and personal autonomy are two factors shaping the level of risk and uncertainty an individual experiences in a health system. Policies help protect a relationship between a trustee (doctor, researcher) and trustor (patient) by defining the terms of engagement and providing rules about accountability and enforceability. Personal autonomy enables flexibility and negotiation that can help a trusting partnership arrive at mutually agreeable terms and conditions. In the health information technology arena, policy strives to balance the need for accessibility among health care providers, public health departments, and university researchers on the one hand, and the privacy interests of the public on the other. Perceived ease of use and accessibility of a system are indicators that an individual has the ability to exercise her autonomy.

Beliefs that policy does not adequately protect against harm may be associated with lower levels of trust. In the political context, failing to demonstrate individual or social benefits of welfare policies has had a crippling effect on their sustainability as a public investment and on public trust. For example, Hetherington (2006) has shown that in the absence of direct benefits, beliefs in government incompetence coupled with mistrust of government have created a self-fulfilling prophecy in which assistance programs have failed to maintain public support not because they are ineffective but because the population believes they are ineffective. This belief weakens public support and thus public funding, leading to cuts in programs which in fact make them less trustworthy and ineffective at achieving their goals.

System Trust

The proposed empirical model defines system trust along four dimensions: fidelity, integrity, global trust, and competence derived from the Wake Forest Scale (Hall et al. 2002b; Rajesh et al. 2003; Hall et al. 2002a; Dugan, Trachtenberg and Hall 2005; Beiyao Zheng et al. 2002). Fidelity is the act of a trustee prioritizing the needs and interests of the trustor (Mayer, Davis and Schoorman 1995), while integrity captures honesty or following the principles of non-deception. Competency refers to the ability to minimize errors and achieve goals, while global trust captures an individual's general or intuitive perception of trustworthiness. It is meant to assess intuitive, rather than rational, aspects of trust (Hall et al. 2001).

Trustor Characteristics

As an individual, one may experience trust as a solitary motive for behavior or belief, while the source of this trust stems from complex belief structures (Lewis and Weigert 1985, 2012). The trustor is bound to draw on intuition and cultural toolkits (Mizrachi et al, 2007), as well as on direct knowledge of the other (trustee) and learned patterns of behavior. The specific constructs considered in evaluating trustor characteristics associated with system trust in the postulated model can be subdivided into three categories. First, there are cognitive/emotive characteristics: knowledge, beliefs about privacy, beliefs about deception from the medical field, expectations of benefit, and an individual's general opinion of data sharing. Second, we can measure experience with the health system in terms of quality and quantity, as well as experience with having one's identity stolen and misused. And third there are the psychosocial factors – self-esteem, altruism, self-efficacy, having a negative outlook, and generalized trust– as well as demographic factors that characterize an individual.

Methods

Data collection

We developed a 20-minute survey to measure predictors of trust in the health system, broadly defined as a web of relationships among health care providers, departments of health, insurance systems, and researchers. The 117-item instrument captured information about factors such as system trust, beliefs about privacy and medical deception, and psychosocial characteristics as well as knowledge of information sharing.

Respondents were surveyed using GfK's probability-based, nationally representative sample of U.S. adults (KnowledgePanel) in February 2014. The response rate was 52.9%. Data from 1,1011 individuals is included in this analysis. Poststratification weights corresponding to the U.S. Census demographic benchmarks for age, sex, household income, education, and race and ethnic background were applied to reduce bias from random sampling error.

Statistical analysis

Descriptive statistics were generated for all variables of interest in the conceptual model [system trust (dependent variable); and policy environment, personal autonomy, and trustor characteristics (independent variables)]. To evaluate the relationship between trustor characteristics, and the independent variables, we examined all predictors of system trust individually (univariable regression) and in one single model (multivariable linear (OLS) regression). To identify a more parsimonious set of predictors of system trust, we used stepwise regression (inclusion criteria, $p<0.05$) and backward elimination (exclusion criteria, $p\geq0.10$). Bonferroni adjustment for multiple testing ($\alpha=0.003$) was applied to the stepwise models reduce the probability of false positives (i.e., type I error, or the incorrect rejection of a true null hypothesis). In this paper, we report the descriptive statistics and the results of the stepwise regression.

We report standardized coefficients (b*), to allow the reader to more easily compare across predictor variables. Standardized coefficients have a mean of 0 and a standard deviation of 1. Larger values of standardized coefficients reflect a greater effect of the independent variable on the dependent variable (system trust).

Descriptive statistics: Demographic factors	**Frequency (n = 1,011)**			
Sex			**Income**	
Male	49.3%		Less than $50,000	60.4%
Age			**Employment status**	
18-29	15.4%		Has employer	50.0%
30-44	21.7%		Self-employed	7.3%
45-59	30.2%		Laid off	13.6%
60+	32.7%		Retired	22.3%
Race/ ethnicity			Disability	6.8%
White	75.8%		**Self-reported health**	
Black, NH	9.2%		Range: 1 (Excellent) to 5 (Poor)	Mean: 2.5 (SD=0.92)
Hispanic	9.7%		**Political affiliation**	
Other, NH	5.3%		Liberal	23.8%
Education			Moderate	35.9%
Less than High School	8.9%		Conservative	40.3%
High School	31.1%		**Views Affordable Care Act/ Obamacare**	
Some college	28.7%		Very favorable/ Somewhat favorable	39.8%
BA or above	31.3%			

Table 18: Descriptive statistics: Demographic factors

Results

Descriptive statistics: trustor characteristics

The sample is split nearly evenly with respect to men and women (See Table 18); 76% are white, non-Hispanic; 9% are black, non-Hispanic; 10% are Hispanic; and 5% are other. Forty percent have less than a bachelor's degree education, and 60% have an annual household income <$50,000. To a question rating self-reported health, asked as "In general, would you say your physical health is… Excellent/ Very Good/ Good/ Fair/ Poor," the mean response was 2.52. At the time the survey was given, about 40% of respondents had a favorable view of the Affordable Care Act (Obamacare). Additional factors measuring psychosocial, cognitive/ emotive, and experience are listed in Table 19.

Descriptive statistics: beliefs about policy environment and personal autonomy

Six questions (See Table 19) captured beliefs about the adequacy of regulatory and policy control over the health system's data sharing practices (policy environment variables).

Predicting System Trust: Descriptive Statistics and Stepwise Regression Models		**Descriptive statistics**		**Stepwise model Model R^2 = 0.516**	
Predictors of System Trust		**Frequency (%)**	**Mean (SD)**	**b***	**p-value**
Beliefs about policy environment (1= Not at all true; 4 = Very true)					
Access to electronic health information is adequately regulated		24.33	2.02 (0.83)	0.19	<0.001
As a whole, the health system is capable of self-monitoring policies that regulate information sharing		26.35	2.06 (0.85)		
As a whole, the health system would be improved if it were monitored by a watchdog organization		32.03	2.13 (0.94)		
Electronic health information is sufficiently protected by current law and regulation		25.35	2.02 (0.85)		
Health researchers are sufficiently accountable for conducting ethical research		33.13	2.24 (0.86)		
I am confident in the standards for keeping personal health information confidential		28.78	2.11 (0.88)		
Policy Index (Chronbach's alpha = 0.82)		Median: 2.00	2.10 (0.63)		
Beliefs about personal autonomy (1= Not at all true; 4 = Very true)					
The health care system is easy to use		22.70	1.91 (0.87)		
If wanted to withdraw from a research study, I would know how		23.83	1.85 (1.03)		
It is easy to access my medical record online		22.27	1.81 (0.98)		
It is difficult to learn about my health from my doctor (Reverse coded)		10.88	3.50 (0.75)		
I could access my medical record if I wanted to		94.07	2.43 (1.07)		
I feel comfortable getting a second opinion when I am told something about my health		63.48	2.87 (0.95)	0.10	<0.001
If I wanted to know how my health information had been shared, I would be able to		17.13	1.76 (0.86)		
Personal autonomy index (Chronbach's alpha = 0.68)		Median: 2.29	2.31 (0.54)		
Cognitive/ Emotive Factors					
Favorable view of data sharing (1=low; 4= high)		70.4%	2.75 (0.69)	0.29	<0.001
Expectation of improvement Index (Chronbach's α=0.79) (1= low; 4 = high)		Median: 2.7	2.61 (0.83)	0.26	<0.001
Knowledge: Average total score (out of 10)			6.1 (2.0)	-0.10	<0.001
Privacy Index (Chronbach's α=0.78) (1=low importance; 4= high importance)		Median: 2.0	2.18 (0.71)		
Deception Index (Chronbach's α=0.79) (1=low; 4= high)		Median: 1.8	1.83 (0.69)	-0.13	<0.001
Experience Factors					
Has PCP	No				
	Yes – not seen in past year	8.1%			
	Yes – seen in past year	73.2%			
Quality of experience with PCP	Negative				
	Positive	65.4%		0.15	<0.001
	N/A	18.5%		0.08	0.022
Has Insurance	No				
	Yes – But has had a gap in coverage	5.8%			
	Yes – No gap in coverage	82.6%			
Quality of experience with insurance	Negative				
	Positive	50.4%			
	N/A	11.1%			
Has had experience with public health department		11.4%			
Identity theft / privacy breach: Has your personal information been stolen/misused? (No)		78.4%		0.08	0.003

Psychosocial Factors				
Self esteem index (Chronbach's α=0.75) (1=low; 4= high)	Median: 3.5	3.40 (0.59)		
Altruism Index (Chronbach's α=0.69) (1=low; 4= high)	Median: 2.8	2.74 (0.65)	0.09	0.002
Self-efficacy Index (Chronbach's α=0.79) (1=low; 4= high)	Median: 3.0	2.88 (0.64)		
Negative outlook: I think the quality of life for the average person is getting worse, not better (1=not at all true; 4= very true)	32.5%	2.13 (1.01)		
Generalized trust: Generally speaking, most people can be trusted (1=not at all true; 4= very true)	38.9%	2.26 (0.82)		

Table 19: Predicting System Trust: Descriptive Statistics and Stepwise Regression Models

About one-quarter to one-third of people felt the statements about the current policy environment were fairly or very true. For example, 24% stated that they felt access to electronic health information is adequately regulated, 25% said that electronic health information is sufficiently protected by current law and regulation, and 29% were confident in confidentiality standards. Twenty-six percent said that the health system is capable to self-monitor systems for health information sharing and 33% cited sufficient accountability among health researchers in conducting ethical research.

In questions evaluating an individual's comfort with accessing and controlling their health information (i.e., personal autonomy variables), most people indicated comfort with getting information from their doctors; for example, 89% felt it was not at all or somewhat true that it was difficult to learn about health from their doctor and 63% felt comfortable getting a second opinion. Smaller proportions of people reported facility with knowing how their health information was used (17%), accessing their medical record online (22%), or withdrawing from research (24%).

Overall prediction of system trust

In the stepwise regression model just eight variables explained approximately 51.6% of the observed variability in system trust. Positive predictors of system trust included one policy control and one personal autonomy variable ("Access to electronic health information is adequately regulated", (b*=0.19), and "I feel comfortable getting a second opinion when I am told something about my health" (b*=0.10)), having a favorable view of data sharing (b*=0.29), having an expectation of benefit (b*=0.26), not having had one's identity stolen (b*=0.08), and having a positive experience with one's primary care provider (b*=0.15). Negative predictors of system trust were knowledge (b*=-0.10) and belief in medical conspiracies (b*=0.13). Comparing the magnitude of these standardized coefficients, having a favorable view of data sharing had the greatest effect on system trust. Notably, factors that did not appear in the final model of system trust include the privacy index and all demographic factors.

Discussion

The European Union is currently engaged in supporting systems that enable information sharing to enhance clinical care, research, and public health within and across countries. TRANSFoRm, for example, aims to support learning health care systems to improve patient safety and accelerate research. Given the importance of the belief that access to electronic health information is adequately regulated, communicating the effectiveness of such policies will go far in assuring the public's trust in integrated health information sharing systems. This will require health systems and those who steward and use health information to demonstrate the ability of policies – regulations, standards, practice – to protect confidentiality and assure accountability and appropriate access. Having trust in confidentiality standards and believing that access to electronic health information is adequately regulated explained as much as 20% of the observed variation in system trust in the univariable analysis (data not shown), suggesting that these are potentially high priority messages to communicate to the public.

Two measures that are commonly implemented or called upon to build trust in systems that share information – allowing easy access to medical records and creating a watchdog organization – were not associated with system trust. European Union countries know health care systems need upstream public engagement to solicit input on what policy and governance models would in fact build trust.

Implications for health systems and technology assessment

As health information flow within and across health systems grows in terms of the amount of data and the frequency of data exchange, the operant form of trust mirrors that found in political systems rather than a relational person-to-person form of trust one might expect between a single health care provider and a single patient. If health information systems can demonstrate the benefits of health information sharing, they could proactively promote trust in the health system.

This survey found that there is a positive relationship between having positive experience with one's health care provider and having system trust, consistent with previous studies (Platt 2015), suggesting there is a role for health care providers in communicating health information sharing policy. There was also a positive relationship between feeling comfortable getting a second opinion about health issues and system trust. These findings suggest that encouraging patient autonomy to seek second opinions is likely to build trust, as is working with the provider community to assume a brokerage role in health information systems.

At the same time, experience exogenous to the health care system is also likely to have effects on trust in the health system. For example, this survey found that some form of digital identity theft has an impact on trust in health information sharing, even after accounting for trustor characteristics, trust in health information brokers, confidence in the policy environment, and personal autonomy. This finding has two key implications. First, it suggests that when, as Taitsman, Grimm, and Agarwal (2013) claim, identity theft becomes an issue within the health care system, it will have deleterious effects on trust in the system at large and its component institutions. Second, even if the health care system is able to minimize the harm from identity theft within the health system, changes outside of the system that increase the probability of harm from digital identity theft may have an impact on trust in the health system. Seemingly unrelated events involving data breaches at large chain stores such as Target and Home Depot, for example, may challenge efforts to increase data fluidity in the health system if the public becomes wary of the exposure of personal information.

Concerns about information privacy were notably not significant in the stepwise regression model of system trust suggesting that while privacy is likely to be an underlying factor and predictive of statistically significant variables in the final model, it is not a good direct proxy for trust in the health system. Furthermore, developing trusted and trustworthy health information systems will require not only robust, secure systems, but also active outreach, communication, and dialogue with the public to engage them as valued and respected system users.

There are several limitations to this analysis that should be noted. First, the stepwise regression model in particular is a conservative model such that factors that did not appear in the final model may nonetheless be important. One would expect privacy to be a key predictor of trust. Moderators and mediators of trust, including risks and benefits, should also be included in a more complete model of trust in the health system, but are beyond the scope of this analysis. Similarly, this analysis did not take into account nonlinear relationships or interaction terms. The data are from cross-sectional and longitudinal studies. Future studies that evaluate interventional impacts on system trust should be undertaken.

Despite these limitations, this paper has identified a set of factors which together explain over half of the observed variability in system trust. As health information becomes an increasingly pivotal part of health care research and practice, policy makers should not let privacy overshadow factors that are as great or of greater concern for assuring trust. Resources would be well spent by addressing communications issues highlighting the ways in which data sharing provides personal and social benefit as well as reducing perceived harm or deception.

References: Page 431

New and Emerging Health Technologies

Reflection on the Challenges for (Health) Technology Assessment

Maria João Maia

Abstract

Health Technology Assessment (HTA) is probably the most complete and common approach to assess a health technology, since according to its definition it studies the clinical, social, ethical, political and economic implications of the development, diffusion, and use of health care technology. However, in my opinion, there is a gap between what HTA practitioners are set out to do and what is being done in reality. Analyzing three examples of new and emerging technologies I gather a set of questions that in my opinion HTA should reflect in order to better meet the challenges assessing such technologies.

Introduction

Technologies used in medicine are usually assessed with a HTA approach in order to evaluate their properties, effects and/or other impacts to inform technology decision makers. To conduct such assessment different aspects such as the social, ethical, economic, legal and financial should be considered.

In this paper, I reflect on possible challenges that HTA faces when it comes to assessing new and emerging technologies, considering that in its definition there is a claim to assess the ethical, legal and especially the social aspects but in practice these topics are not being completely covered leading to a discrepancy between HTA definition and its practice.

In the following I explore the concept of HTA and I try to relate its definition with the practice and the challenges faced when assessing emerging technologies. I present some examples of new and emerging technologies in healthcare and explore some challenges that HTA can face, before concluding with a brief set of questions that, in my opinion, HTA should reflect upon.

Development of HTA: Brief Introduction

In order to improve health, there is a need to bridge research with policy-making by the use of HTA studies. The field of HTA studies was shaped by the first reports of the U.S. Office of Technology Assessment (OTA) focusing health technologies in 1976 (Banta and Jonsson 2009). In the 1980s, the term "healthcare technology assessment" became a dominant one (Banta 2009) and since then it has developed into an international community, dedicated to TA on healthcare issues (Hennen 2004).

In literature, one can find many definitions of HTA, such as "the systematic evaluation of the properties and effects of a health technology, addressing the direct and intended effects of this technology, as well as its indirect and unintended consequences, and aimed mainly at informing decision making regarding health technologies".[1] Granados et al. (1997) say that "HTA does not claim to provide a definite solution to a health care problem, but to assist decision makers with evidence-based information about the clinical, ethical, social, and economic implications of the development, diffusion, and use of health care technology".

Most of the definitions emphasize HTA's role as a decision-making support tool at different levels of the healthcare system with its multidisciplinary nature and reliance on transparent scientific exact methods. In order to conduct a good HTA, in principle, a combination of several aspects should be taken into account such as social, ethical, political, economic and legal.

Despite its claims, over the years HTA is mainly focusing its assessment on reimbursement, safety and effectiveness aspects, with considerable analysis on economic issues, namely cost-effectiveness and budget impact. Assessments considering organizational aspects or social and ethical issues of the impact, diffusion or use of health technologies are scarce,[2] despite the demand for a broader approach that includes social and ethical impact, effects on patterns of healthcare demand and other issues (Mowatt et al. 1996).

Many reasons can explain this reality such as methodological difficulties to integrate topics such as ethics[3] and social impacts[4] in the studies, leading to a discrepancy between what HTA claims to do and what it actually does in practice.

From Science Fiction to Healthcare

Since it can be considered a vision about future technologies, science fiction can play a powerful role when it comes to expectations raised on the development of medical technology. Science fiction writers or visionaries, with their future oriented way of "seeing" the world allow us to anticipate medical changes. I will present three examples:

Example 1: Surgical Robots

The introduction of the da Vinci Robot (assistance robotic system) in the operating-room provided a set of changes at different levels. For instance, in terms of clinical aspects, diminished blood loss, reduced recovery period, decreasing the size of the scar, among others, are considered to be advantages of the use of the robot. However its malfunctions have affected thousands of patients

by causing complications and prolonged procedure times. The overall numbers of injuries and even deaths as a consequence of the use of the robot have stayed relatively constant over the years, which implies that there is still much to be researched and developed concerning instruments improvement and human-machine interfaces (Alemzadeh et al. 2015). The organizational aspects should also be considered with special focus at the work level. With the introduction of the robot, the surgeon does not interact with patient tissue as he is seated in a different room (usually) commanding the robot. This distance divides the team, implying for new ways of communication among team elements. Other aspects to be considered rely on the lack of professional knowledge when dealing with the robot and the need to have a permanent learning process. The emergence of new professions and the emergence of specialized departments/hospitals can also be consequences of the use of assistive-robot surgery (Maia and Krings 2015).

These aspects should have been considered and properly assessed before the introduction of the robot in the OR. Despite this facts robotic surgical systems have been successfully adopted in many hospitals.

There is a vision to achieve complete automation in the operating room[5] and for this reason HTA should focus on the possible consequences of such scenario since the impact of robotics on the organizational working environment, is still unknown and questions on medical responsibility, competences, equity in access and even architectural re-structuration of surgery departments or even hospitals should be the aim of further research.

Example 2: Nanomedicine

One of the aims of nanomedicine, is to transport drugs and deliver them directly to a specific place, with no losses or cell damages along the way. This targeting delivery, using nano-robotics for example, aims to replace invasive administration of drugs by non-invasive. Once inside the human body, nanorobotics would also be able to perform nano-surgery, such as the removal of plaques build along the walls of arteries or even breaking to pieces kidney stones with the use of powerful small lasers.

In diagnosis, a shift from curative to preventive medicine can occur as the aim is to develop contrast agents by means of nano-based structures,[6] which will allow the enhancement of image details, enabling diseases to be detected in a very early stage of development and allowing for that specific disease to be treated even before the first symptoms can occur.

In 3D organ printing, a "personalized medicine" can be achieve with nano-substances that can be used as biocompatible materials, aiming a better interface with the human tissue leading to an absence of organ rejection.

Although there are great hopes set on the potential of nanotechnology, responsibility in research and in adoption of this technologies requires for a deep understanding on possible consequences on the use of such technologies and materials. Research on the social, ethical and legal implications on the use of nano-based technology is needed as well as public awareness on the topic since several societal impacts can emerge such as inequalities in access, misuse of technology, among others, with the introduction of such technologies.

Example 3: Assistive Technologies

Neuroprosthetics are already implemented in the market and some are widely used, such as the cochlear implant for hearing. Others are being developed such as bionic eyes, legs and arms.

Neurotechnologies such as Brain-Computer-Interfaces (BCI) can be used in the future to maintain and allow communication between severely paralyzed patients. In this specific case, the ethical, psychological and social implications of the use of BCI can include the prevention of premature death decisions by physicians.[7] Other applications include the control of wheelchairs or the use of keyboards (Wolbring 2005). In the future, BCI has the potential to impact not only individual users but also society as a whole since it is expected that not only impaired or disabled people will use assistive devices but also "normal" people aiming to enhance their performance leading to an increasing difficulty to distinguish therapy from enhancement in general and therapeutics and non-therapeutics enhancement in particular (Wolbring 2005). It is important that HTA also focus on topics such as "dissolutions of boundaries" between humans and technologies and personality changes as side effects of neurotechnologies uses. A reflection on the social, ethical and even legal impacts of neurotechnologies on society should also be a requirement for a HTA approach.

Reflection on the Possible Challenges for HTA

Since a variety of different technologies with different roles and purposes are now emerging it is difficult to tackle all possible implications and impacts. In an attempt to understand and anticipate them, HTA can be conducted in order to support decisions on development, adaptation, diffusion, acquisition and use of new and emerging technologies.

To understand the impact of technology in society and the impact of society in technology, a more participative approach is needed, aiming at the improvement of public debate quality. That is, people need to be enlightened about the topics at stake so they can participate in the debate and be able to contribute with their doubts and concerns. Therefore HTA should provide public participation with scenario analysis, citizen's summits and strategic planning, for instance, in order to enrich public debate.

While HTA is more focused to economic aspects, studies with a strong focus on the societal context of technology or the interactions between technology and society has actually been the topic for classic Technology Assessment (TA) (Oortwijn et al. 2004) but since the tools that TA and HTA apply don't have a "sharp distinction" regarding its content, both, HTA and TA should learn from each other (ibid., Wolbring 2005).

HTA could also learn from Constructive Technology Assessment (CTA), another approach to TA, that shifts the focus away from assessing impacts of new technologies to broadening design, development, and implementation processes (Schot and Rip 1997).

For the above mentioned reasons, some authors argue that "HTA needs to continue the expansion of its methodological perspectives to include organizational, ethical and social issues more systematically and more frequently" (Røttingen et al. 2008:168).

Considering the three examples of the new and emerging technologies presented above, HTA should reflect for instance, on the following questions:

- Are these technologies being evaluated appropriately? How should new medical devices be regulated? How can the boundary between therapy and enhancement be evaluated?
- What ethical choices should guide the evaluation, adoption, and use of these technologies whose long- and short-term effects may not be known or clearly understood? What are the morally relevant consequences of the implementation of emerging technologies?
- In what ways are these technologies influencing - and being influenced by - organizational changes in the health care mark place? Does the technology in anyway challenge or change the relationship between physician and patient? How does the technology contribute to or challenge professional autonomy? Or help to shape new emerging professions?
- For some people, Can the access to these technologies be impeded for specific groups of patients? For what reasons? Individuals that can have access to resources can have access to their own enhancement. Will this create social inequalities for those who cannot?
- How can these technologies affect societal behavior and organization? What impact can emerging technologies have on the health and wellbeing of individuals? What do people think about these new and emerging technologies? Are people being allowed to accept or decline such technologies?
- What role(s) should governments (at different levels) play in dealing with these issues? How can decisions on emerging technologies be improved since availability of relevant data, within a realistic time, may not often be present? Researching on the legal, social and ethical aspects that can be raised by the introduction of such new and emerging technologies is a way for HTA to present a report that focuses all aspects in order to prepare and guide decision-makers as well as citizens when the time to make critical decisions arrives.

Despite the challenges, the integration of more disciplines in HTA studies is also a way to assure a reflection from different perspectives on possible futures and the related regulatory challenges.

References: Page 431

Seeing Again. Ageing, Personhood and Technology

Ike Kamphof

Abstract

This paper discusses how telecare technology affects the personhood of frail elderly clients within care relationships. Against the background of – largely speculative – promises and fears, it presents the results of empirical phenomenological research into the use of activity monitoring technology in Dutch homecare. The paper shows how technologically mediated processes of "seeing" frail homecare clients "again" involves a dynamic mixture of human and technological seeing and marks a number of points of tension that need to be addressed in order to secure respectful use of this technology. It suggests that this requires a process of "reflective implementation" and "reflective design".[1]

Introduction

The question addressed in this paper is how new telecare technology, as used in homecare, affects the personhood of frail elderly clients. Personhood, as Kitwood (1997) argued, is bestowed on us by others; it is about how we see and recognize each other as human beings and on that basis how we treat each other with due respect. Telecare technologies are not neutral tools. They affect and transform processes of perceiving and of responding to clients in care relationships. The way telecare technologies "mediate" (Ihde 1990, p. 17) care relationships belongs to the "soft impacts" of technology (Swierstra 2013, p. 203), the nuanced social, cultural and moral changes technologies provoke, that are largely ignored in the existing discussions.

The current discourse on telecare is dominated by promises and fears that are largely speculative (Pols 2012). Proponents argue that telecare, by making care more efficient, can save national healthcare systems from the organizational and financial challenges posed by an ageing society. Critics point to the danger that warm human care will be replaced by cold machines. Both promises and fears mainly consider the structural potential of technologies in relation to care practices as they exist today. They ignore that technologies actually transform care practices and that users co-shape the meaning of technologies.

This paper presents an alternative approach. Based on an empirical study of one specific case – activity monitoring technology, as used by three homecare organizations in the south of the Netherlands – it discusses what telecare technology means for the everyday care relationship of its primary users, caregivers and frail elderly homecare clients. On the basis of phenomenological observation and the analysis of activity monitoring technology in use, it brings out the emergent structure of one specific telecare technology. It detects points of tension in this structure that are in need of further discussion if we want to improve the implementation and use of this technology. With this, the paper aims to contribute to a much needed process of what could be called "reflective implementation" and "reflective design" of telecare. Such a process is open to change in response to tensions that emerge in practice.

Care's "Extra Eyes"

Activity monitoring technology employs motion sensors, placed in the homes of frail elderly people, to track daily patterns of sleeping, eating, toileting and general activity. These patterns are scanned for significant changes in activity as compared with ordinary patterns for this person that may indicate emerging problems with health or well-being. For instance, the system signals when a client stays in the bathroom longer than an hour, which could indicate that a person has fallen. It scans whether the fridge is used regularly as a sign of meal preparation. Through sensors in and outside the bathroom, the system detects whether a person is up and about at night more than usual. This information is made available to the coordinating caregivers for a particular client through a password-protected website. Significant changes – whether large and acute (code red) or more gradual (code yellow) – are sent as SMS alerts to their cellphones. Activity monitoring does not replace face to face care, but works in conjunction with physical care for frail elderly people living alone at home, in particular for people with dementia.

Activity monitoring technology offers caregivers, in the words of a manager, "extra eyes" that enable them to "see" their clients in new, technologically enhanced ways. In this paper I will take "seeing" both literally, in the sense of "observing", and metaphorically, in the sense of "acknowledging" another human being. The Latin term respecere, from which the word "respect" derives, literally means "seeing again". The existing debate on the promises of and fears for activity monitoring technology can be considered as being about different ways of "seeing" frail elderly people.

On the one hand there are the promises that the "extra eyes" will enable caregivers to detect emerging problems with health and well-being at an early stage (Glascock & Kutzik 2006). In this way, homecare hopes to prevent or postpone hospitalization and residential care to support the independence of frail elderly people and to provide more targeted and personalized care. "Seeing" is here taken as "obtaining more accurate knowledge" and there is an expectation that this automatically leads to improved as well as less costly care.

Critics on the other hand refer to the disrespect that accompanies technologically enhanced observation (Kenner 2008; Brittain et al. 2010). They point out how activity monitoring stigmatizes elderly people as a group that is "at risk" and incapable to take care of themselves, how monitoring will invite intrusion into the private sphere of frail people in order to manage the risks they are prone to, and how technology hides individual persons behind datasets. They argue that the implementation of this technology shifts the focus in care from the needs of frail people to those of the healthcare system in need of a "technological fix", and warn that monitoring threatens to erode human care relationships.

Within the scope of this paper, I can only present a limited number of results from my empirical work. This work shows the actual situation as complex, ambiguous and more nuanced than the current debate allows.

1. Structurally, with two kinds of alerts, code red and yellow, activity monitoring technology emphasizes risk. However, in actual practice code green, signifying that "all is normal", plays at least as large a role for both formal and informal caregivers. Caregivers tend to worry about how a frail person under their care is faring when they are not around. Code green reassures them that the situation appears to be in balance and is still tenable. As such the system can be said to communicate both disabilities or risks and retained abilities for self-care of frail elderly people.
2. By tracking individual patterns of living, activity monitoring does not simply make persons disappear behind their data. It also re-familiarizes overly busy caregivers with their clients. Caregivers interviewed in my study claimed, often to their own surprise, to feel closer again to their clients as individuals. Technologically enhanced observation that detects personal rhythms of living turned out to also lead to new care obligations. For instance when caregivers, through the technology, observed that their client was awake much earlier in the morning than the hour homecare would arrive to assist them with washing and dressing, this was felt as deeply problematic and as ignoring a person's needs. Responding to the individual rhythms of clients, however, demands an as yet unresolved reorganization of the way homecare organizations work.
3. Alerts and data do not provide meaningful information by themselves. They do not simply represent knowledge, but instead require constant interpretation based on the caregivers' familiarity with their client and his or her life. In other words, the data generated by the technology need to be "re-seen" by caregivers to become a useful element in care work. For instance, the technology might send out a low meal-activity alert on a day caregivers would know their client was eating out. And what does night time activity, signalled by the system, actually mean? In the case of one client it could be connected to adverse effects of administered medication, with another it can signal beginning dementia, and with another it may simply come with a lifelong habit of being a "nighthawk". Data presented by the system could show a lack of activity in the home of a client, but not whether someone had fallen, was having a nap or was telephoning with friends. In the case of meaningless alerts, like the above mentioned meal alert, caregivers had to ignore the data in order not to disturb their clients unnecessarily. Whether and how to follow up alerts demanded constant re-examination of data by caregivers in light of what they knew about this person. This means that, while the system can supplement human seeing in some ways – for instance by communicating individual rhythms or by detecting gradual changes not easily noticed by humans – its data in turn need human eyes and the familiarity that comes with active care relationships to become meaningful.
4. While some clients welcomed being watched over, others indeed experienced activity monitoring technology as stigmatizing. In all cases, monitoring technology only functioned well when embedded in a relationship of trust. The current structure of the technology that captures data unobtrusively to transport them out of the home to be read and judged elsewhere could use improvement to enable such a relationship. The message presently conveyed by the system to clients is that their data are not their own. Nothing in the current shape of the technology assures clients that their data are safe and to be used for their well-being only. At present, trust is built and sustained by the communication skills of caregivers. However, caregivers are also dependent here on the context provided by the healthcare system at large and on how parties such as management, insurance and government decide to use the

data generated by the system. If these uses would involve, for instance, judgments on the kind of care someone is entitled to, the relationship of trust on the work floor is severely threatened.

5. Caregivers are very sensitive to clients' privacy. As a result they developed ways of not checking more data than they actually needed. They ignored data displays that they experienced as a disrespectful surplus. Doing this, they showed that the extra eyes provided by technology not only needed their own human eyes to "see" data "again" in the light of individual clients, but also, at times, the closing of their human eyes in order to secure respectful care. Here too, the technology led to tensions. The simple availability of data also made caregivers fearful that they could be held accountable, not just for what they did observe, but also for what they could and maybe should have observed. In other words, the mere presence of the technology urged them to watch more data than moral inhibitions about the privacy of their clients would allow them to.

Conclusion

Respectful use of activity monitoring technology involves a dynamic interplay of technological and human seeing and not-seeing. Activity monitoring technology enables caregivers to see their clients, including their disabilities and their abilities, and their individual rhythms of life, in new ways. In this activity monitoring can actually enhance the personhood of frail elderly people when it enables caregivers to come closer again to their clients as individual persons. Activity monitoring also requires caregivers to interpret data, observed by the technology, in the light of their own acquaintance with their clients as persons. At times it demands them to close their eyes to overly overt data displays to secure respectful care, while at the same time inviting, even forcing them, to look at these. This complexity demands that the implementation of technologies like these makes room for education but also for ethical deliberation on how to deal with these tensions.

My research also demonstrated potential tensions about the purposes for which data are or could be used by various parties involved and how these uses could impact care relationships as relationships of trust. It further showed how the current shape of the technology could use improvement from the perspective of clients. Increased transparency about their data for clients could also support caregivers more explicitly in building trust.

Technologies receive their ultimate meaning within actual processes of use. These processes often bring out unforeseen problems and tensions. Proper implementation of telecare can only succeed when processes of design and implementation are more open to change than they are now. Schön (1983) identified how the success of professional practice is based on openness and the ability to respond with sensitivity to an always changing environment. He called this ability "reflection-in-action" (p. 21) and the practices "reflective". Caregivers in their attempts to give the technology a meaningful place in their work demonstrate such reflection on a daily basis (Kamphof 2015). However, on a more general level, the implementation of new technologies in healthcare would be helped with what could be called processes of "reflective implementation" and "reflective design". In such processes emergent practices of use would be allowed to talk back and suggest adjustments to implementation and design in order to secure good and respectful care.

References: Page 432

About the Attraction of Machine Logic

The Field of Elderly Care

Bettina-Johanna Krings and Linda Nierling

Abstract

In Europe, specifically in Germany, the ageing society is discussed as a challenge where (new) technological developments are often considered as significant solution to overcome structural problems in elderly care. This paper strengthens very much the hypothesis that the political and scientific discussion on demographic change can be currently characterized by a strong technology-push approach, whereas the perspectives of the addressees of these 'care technologies' are often not taken into account. Consequently, this technology-push approach tends to neglect institutional practices and everyday routines in the care sector. Providing insights from an empirical study in impatient care, the role of technologies in the care sector is elaborated from the working perspective in this paper. Hereby the current situation in the care sector regarding organizational as well as occupational issues is outlined in order to explicate the specific role of technologies in this sector.

"The mechanistic paradigm and its related culture of technology have been evolving for several hundred years, and their influence in nursing, like other health-relating disciplines, is far-reaching: so much so that the explicit and implicit assumptions and beliefs about human beings are no longer even recognized." (Mitchell 2001, p. 34)

Introduction

Usually, political and public discourses on ageing circle very much on the 'demographic challenge', they pose for society. In Europe, specifically in Germany, this challenge is covered by expectations on (new) technological developments which are meant to resolve it. Thus, technologies like Ambient Assisted Living (AAL), telecare systems or even the idea of service robots are very prominently discussed as potential solutions for this societal vision. Coupled with the problem of rising costs for health systems in European welfare states as well as the lack of qualified personnel, the use of technology is often considered in public debate as significant solution to overcome structural problems in elderly care. Surprisingly, the attraction of machine logic is directed to maintaining the 'autonomy' of elderly persons here. This means technology-based solutions should provide models of independent living, basically at home. How these hopes meet the expectation of supporting care activities seems widely open within these discourses (Krings et al. 2014). Other implications of technological innovations in this field, like social, institutional or even cultural issues, are rarely discussed within these expectations. To sum up the discourse, it can be stated that the social construction of technological environments (Bijker et al. 1987, Grunwald 2010) in the field of elderly care seems widely lost within these future technological visions.

However, as these discourses show, technical promises are commonly addressed to several social groups with different perspectives on care. Generally, the addressees are the elderly people themselves and caring family members as well as professional nursing staff in institutions at the same time. The key word within these visions is 'efficiency', which means that care activities should allow to keep elderly people controlled, supervised and 'cared for' more efficiently, supported by specific technologies. Without doubt these visions are going hand in hand with the deep wish of the elderly to maintain their daily living routines and also handling their bodily and physical needs autonomously as long as possible. But at the same time experiences show that technical efficiency neither covers the needs of the elderly people nor those of the professional nursing staff or caring family members completely. In contrary, technologically supported caring environments are all aligned to a single and specific situation which is embedded into a particular caring context. This paper very much strengthens the hypothesis that the current political and scientific discussion on demographic change can be characterized by a strong technology-push approach, whereas the perspectives of the addressees of these "care technologies" are very often not clearly taken into account since this technology-push approach tends to neglect institutional practices and everyday routines in the care sector. This critique is also significantly expressed in the following quotation:

"The rational and efficient world of health care has a tendency to overwhelm the human and subjective world of patients and nurses. Therefore, excellence in nursing practice demands further involvement with issues related to ethical, gender, economic, theoretical, political and intellectual aspects of technology." (Bernard 2001, in: Hülsken-Giesler 2008, p. 279)

In order to strengthen the hypothesis, we provide insights from an empirical study in impatient care. Based on a mix of qualitative methods, the role of technologies in the care sector is elaborated from the working perspective. The following research questions are addressed in this contribution: 1) What are the roles and the impacts of technologies in the field of elderly care? and 2) How do technological visions change the working life in care?

Demographic Change and the Technology-push Discourse

The future demands on elderly care in an 'aging society' are regarded as a central societal problem, or rather frequently even negatively interpreted as an 'over-aging' of society. Very often statistical data of demographic change is used to illustrate the societal challenge of

an aging society. For example, in the next years and decades the population structure in Germany will change dramatically. Until the year 2050, the population will develop in two directions that strengthen each other correlatively: on the one hand, a drastic decrease of the population is estimated; on the other hand, the share of old people will significantly increase. Furthermore, life expectancy will continue to rise by seven to eleven years over the next fifty years. In figures: while Germany had 82 million inhabitants in 2009, including 17 million aged 65 years or older (21%), the number of inhabitants older than 65 years will increase to 22 million (29%) by 2030 (Statistisches Bundesamt 2011).

Apart from the future organization of retirement funds or the health care system, the future organization of elderly care is regarded as a central challenge for an aging society. With a rising number of elderly persons, increasing cost pressure and a small number of qualified personnel available in social areas, the demands of elderly care are increasing. Due to these shortages the current situation can be characterized as a 'crisis in care'. As one solution for this crisis, the technological visions have a high prominence in this debate and are intensively discussed to support the lives of the elderly at home as well as care in nursing homes. Technological developments in different fields are proposed to support the care of the elderly, e.g. monitoring, assistance, control systems, interactive systems. Last but not least, they promise new, innovative products and markets which are also serving political and industrial interests.

In the German political discourse, these technological innovations in elderly care are regarded as necessary to offer an adequate supply for the elderly in the long term and are especially pushed by research policies addressing technological visions across disciplines. Following a technology-push strategy, the further use of technology within care is frequently determined by existing technologies or paths of innovations. At the same time, personal needs, fears, wishes and emotions as well as concrete living arrangements of elderly people in need of care are often not included in the development of technologies. It is also very difficult to evaluate them, as they touch private areas with a high emotional component (Mol/Moser/Pols 2010).

Case Study: Impatient Elderly Care

The empirical findings for the case study on impatient elderly care come from the BMBF-funded project MOVEMENZ[1] which focuses on the mobility of elderly people with dementia. For this paper we carried out a secondary analysis of the qualitative survey conducted in the project which encompassed methods like participatory observation as well as individual and group interviews with the elderly and professional staff. The institution which provides the framework for the study is an elderly care institution managed by a private organisation running many homes for the elderly. It is located in the South of Germany, employs 10 professional nurses and 8 nurse aids and accommodates 49 women and men between 66 and 98 years who suffer from dementia.

In the following, the interpretation of the empirical data will focus on care activities as the main tasks of the care professionals in the institution. The research questions specifically strengthen the overall expectation that technological innovations are able to support the 'efficiency' of the working processes of care professionals. In order to provide a comprehensive picture of the different dimensions of care, the results will be presented around the following analytical levels: Organisational, occupational and technological dimensions of care work.

Organisational Dimension

The organisation, like other German care organisations, is dependent on the German legislation on care, implying a high cost pressure which finally leads to a new division of labour in this organisation: At first, high-skilled care professionals complete the "core care work" with the elderly like bedsore and wound treatment, positioning in the bed and washing. Second, there is a group of low-skilled care professionals, nurse aids on a very low income level (so-called "400 € jobs"), who assist the elderly in their daily routines or provide support to maintain their mobility and other activities. Third, there is a group of volunteers who take over the part of social and emotional care, who talk or play with the elderly. As a "status quo", daily working life in this institution has been characterized by professionals and assistants as stressful. Due to cost and time pressure which is created by management strategies as well as by the division of labour in "care and assistance", both professionals and assistants experience an increase and intensification of work as well as additional work, more administration and documentation. Their own idea of their 'core work' seems to be more and more under pressure here. This is well described by the following quotation which shows that there is not enough time for the individual patient in the working routines:

"… to decide in an instant that it's not about the usual "food and washing", but taking the time to sit by the bed for five minutes and then it's ok. I know when she had a shower, we can sign this, because we did spend the time there – I think you don't have to be nit-picking here … at least that's my opinion – and this person is happy. She got the necessary personal care and also some time for talking, and it took me as long as helping her shower. But taking this decision when you know there are five others waiting is really difficult…" (interviewee)

Social interaction and the establishment of a relationship as part of professional care work are still recognized as crucial for the quality of their work by the professionals. However, as the results show, institutional 'caring' models are changing towards those embedded in a more technical and administrative setting where cost efficiency may be controlled and monitored. This development is strongly criticised by both professionals and assistants.

Occupational Dimension

The occupational profile of care professionals is very much shaped by work intensification and up- and deskilling processes (distinction between professional and assistant nurses) in the sector. This is also the case in our empirical study. Furthermore, most of the professionals also formulated the lack of psychological supervision which they consider as important part of their occupational profile. Since care workers are regularly confronted with the topics 'end of life' and the 'death' of people with whom they have developed emotional relationships, coming to terms with these topics is a crucial part of their working life. With regard to the high percentage of elderly people with dementia, there is also a gap between specific professional demands and the responses within the institution. Although there are "in theory" specific qualifications for dealing with dementia patients (e.g. from the fields of ergotherapy or biographical work in which nurses are trained), there are only two professionals with additional qualifications with regard to the care situation of dementia. Also here the professionals agreed that an institutional support of these additional qualifications would provide better methods for the care of elderly people with theses specific characteristics. Therefore, daily working life is very much influenced by the institutional framework, e.g. that nurses have to comply with the given time frame for the care of the elderly person, as the following quote illustrates:

"… there are these limits, when we don't have the time, that's often really hard. You have those people who need a little bit more time with you, but then someone else is ringing, and there are four or five other people in bed who also want to get up and, well … Because everybody … Sorry, but some people need more time in the bathroom, but we have to hurry on … no time." (interviewee)

However, the occupational group is highly reflexive about the occupational demands of their job, regarding their professional ethics and the quality of care, which includes a high share of interpersonal relations, empathy and emotions. They are also critical about the low societal recognition of their professions which is strongly reflected by the low wage level in social fields.

Technical Dimension

In principle, two types of technologies can be distinguished that are discussed and applied in the case study, which – in contrary to other cases – does not focus strongly on technical equipment. But nevertheless, basic technologies of the care sector are introduced: Basic and established technologies, like wheel chairs, wheeled walkers, emergency calls, lifters at the bed or in the bathroom, etc. These traditional 'care' technologies are, according to the professionals, extremely helpful and working without this technical support is unimaginable today. Reflecting on new and visionary technologies like multifunctional wheeled walkers (GPS & motor-driven incl. display), tablets with photo memory, cell phones with special functions, apps, digital environments, etc., the professionals seem open-minded towards the use of this type of care technologies which would activate the elderly and facilitate their work. However, they show a clear perspective with regard to the use of these technologies, that they should take on a functional role within the care sector. These functions should be explored, evaluated and adequately embedded into the working routines of the care personnel. Thus the role of technology basically seems important, but the functions should serve the elderly people and the care professionals. That means technologies should not get a dominant role based on promises of higher efficiency and/or substitution of human work, as the following quotes illustrates.

"... Technology would of course help in caregiving, but always together with the carer, not: I'm gonna send the robot and it will do what I tell him, but: I'm there as well and have some technical assistance." (interviewee)

Thus, they do take on a critical attitude towards the technology-push discourse which neglects the care occupation and its professional quality within care.

Conclusions: Who is Attracted by the Machine Logic?

What can we conclude from the empirical findings of the study for the research questions with respect to the contribution and the impacts of technologies in the field of elderly care? At first, one can state that technical developments and technologies are already integrated into the care sector and generally appreciated by care professionals. However, there is a strong plea from the sector to rather improve established technologies and adapt them to working routines (e.g. nursing beds) than to invent new and visionary technologies in the field. This plea gets its grounding when reflecting on the effectiveness of the strong push of technological visions by R&D so far: Although they often go with a strong focus on demand-driven research, they have mostly punctual impacts. Last but not least, our exploration in the care sector showed that technological solutions are only one part of the whole picture. Thus, it clearly seems most important to integrate appropriate technologies in strategies offering solutions for the crisis of elderly care than rather focusing on the present institutional and organizational shortages in the care sector. Reflecting on current problems of the care sector, the ongoing intensification and fragmentation of care work, the missing societal recognition of care work should also be publicly discussed. Positively supporting the dignity of care professionals under current working conditions definitely would be an important step to resolving current and future problems of ageing societies.

References: Page 433

Values or Technologies – Chicken or Egg?

Aspects of the Mutual Dependence of Values and (Assistive) Technologies

Ulrike Bechtold

Abstract

Four mobility and security scenarios from the European research project "Value Ageing" help us to think about potential challenges that may emerge from a widespread use of ambient assistive technologies (AAL). The question is whether these technologies not only reflect ethical considerations and societal values in their making, but may also in some respects directly affect such values when used. This question reflects the social construction of technological environments for older adults and other demographic factors, and benefits from a technology assessment perspective.

AAL is expected to foster positive effects on the individual and/or society related to security, skills and cognition, and autonomy. To fully unfold its supportive function, ambient assistive and intelligent technology makes decisions. This requires defining good/bad and desirable/undesirable with regard to a technology while it is still in development. However, actual applications and hence real-world settings may require quite different distinctions.

Introduction and Background

For this paper, four scenarios as used in the Value Ageing project (2012-2014) are analyzed to explore the relationship between technology and values. The aim of the project ***Value Ageing*** (VA) is to incorporate European fundamental values for ageing into ICT, which was framed as a vital political, ethical, technological and industrial challenge. To achieve this, VA explored relevant aspects of the incorporation of ethics and social considerations into assistive technology (AT), and to tried to understand how AT affects their users and to uncover the values inherent to AT and technology choices. This follows the rationale that "the technology development process is flexible – the technology can be optimized – depending on the values that are (successfully) fed into the process". In this contribution I want to go beyond this position and propose that technology use may influence the users´ values and world making, and that this may develop momentum (see also Von Schomberg, 2013 regarding momentum on the market level). Such an impact may not exactly parallel the values assumed to be inherent to the technology. The social effects of technology have been examined in many contexts (e.g., Ganascia, 2010 for social media, or Barland et al., 2014 for security and surveillance technologies).

In VA, a scenario approach served to identify the main challenges for decision makers. The goal of the scenarios was to facilitate exploration, stimulate insights, and formulate recommendations for research and technology development (RTD). The scenario generation was inductive and based upon qualitative inputs using participatory methods and user group involvement in the scenario process (Tingas, 2013). The scenarios are short narratives, constructed around a number of criteria and framework conditions (e.g., the protagonists are 40-85+ years old; identification, wireless and augmentation technologies are used; an event occurs that changes or disrupts the original situation, and the protagonists react; the time frame is approximately 2030; for more details see also Mantovani, 2012).

For this analysis the following four (out of twelve) scenarios which contain the topics mobility, security, and activity were selected:

Who will be the witness? – is about three elderly friends who are on their way to their favorite meeting point. They all have to cross dangerous areas, so they try to protect themselves by employing different forms of portable security devices. They finally choose a live-cam security device, but in the end foggy weather turns out to present new obstacles to their security (one of them gets a proxy officer and feeds his pics to police files).

The bus was full – grandmother fetches her granddaughter from a (RFID chip-secured) school. An electronic access control system on the bus denies her to access the bus, but the bus driver lets her on because he knows her. A controller gets on bus and seriously reprimands the bus driver, creating an unpleasant situation for everyone.

The tumbling dice – The protagonist is a woman in her late eighties. She is a senior student who has to commute quite a distance to the university. Her driving license was recently withdrawn because of her bad eyesight. Her car was blocked with a drive-lock. She tries several forms of public transport but is not happy. Finally, car-sharing may turn out to be a good solution; she keeps on hoping that medical improvements will help her to get back behind the steering wheel. A petition claiming that these ambient law cause interventions that violate one's individual rights gives her further hope!

The Network - The protagonist is an approximately 65 year old man who is very lonely but spends his time creating virtual networks and relations. He gets so involved that he gradually starts to prefer his virtual surroundings to the real world; he has trouble doing his shopping because the electronic payment service does not work.

The scenario analysis (Bechtold and Tingas, 2012) identified 14 main ethical challenges that users face when confronted with identification, wireless and augmentation technologies for older citizens (see Table 20).

DEMANDS	Customizable technology	Technology (including AT) can be adapted to different (individual) user needs and preferences.
	Informational privacy	Information about and control of the individual in terms of data collection, transfer, and storage.
	Local privacy	Distinct from informational privacy, local privacy can be defined as an individual's right to control their own personal space (at home or in public), including monitoring and surveillance activities.
	Personal security	Protect persons (or groups) from external harm, e.g. through sensors for authorized access, security cameras, CCTV.
	Universal technological access options to public services:	Based on the EU's nondiscrimination principles, access is important for all persons. Different dimensions of access are: economic power, abilities and skills, as well as technological infrastructure issues
	Freedom of choice	Choice between different types of (assistive) technologies and the option to refuse the use of the respective technologies.
HOPES	Social integration and communication	Technology that enables elderly people to remain socially active and facilitates access to advice, assistance, information, and education and entertainment services both inside and outside their home environments.
	Self-realization through technology	Individuals choose how to (socio/psychologically) identify and redefine themselves through technology.
	Autonomy	Being self-determined in terms of freedom of choice (as mentioned below) and remaining independent from AT, so that abilities and skills do not lead to a decline in the capacity to be autonomously defined as an individual who is able to decide what (not) to do, when, where, with whom.
	Remain active	Continue an independent and active lifestyle, e.g., including work (volunteer or gainfully employed).
FEARS	Technology replaces human being	Technological solutions replace the presence of a human being to fulfill certain tasks; this technology may also make decisions.
	Human dependence on technology	Dependence on technology (hardware and software and continuous updating of these) to fulfill activities of daily living.
	Technology failure	The original purpose of the technology is not fulfilled in a certain situation. Also known as the fallibility issue.
	Societal outreach/dual use	Some technological developments (e.g., care robots) contain perspectives of ICT developments going beyond their original context. These might find their application in other thematic areas (e.g., education) and for other demographic groups (e.g., care for babies etc.).

Table 20: Demands, fears and hopes connected to the use of assistive technology

Implications for Security, Cognition and Autonomy

The identification of ethical entanglements may help to create guidelines for adequate RTD of AAL, but there is another question worth considering. Do certain technologies not only reflect ethical considerations and societal values during their making, but also directly affect these values during their use? For example, what does it mean if the use of a certain app results in a significant alteration in the proportion of time spent in cooperation with technology? The question whether the use of technology may alter users´ values derives from the social construction of technological environments for older adults and other demographics. Consideration of this question may benefit from a technology assessment perspective, i.e., from critically rethinking different aspects of this very question in different contexts. This is the purpose of the four chosen scenarios in the following paragraphs. They were thoroughly analyzed as to how assistive technology may affect or even change human values and attitudes.

Generally, AAL is expected to foster positive effects on an individual and/or society with regard to the quality of life of older adults. In the following "security, technology dependence, and autonomy" were selected as categories which contain aspects potentially relevant for altering values in the context of the use of assistive technology. The areas mobility, activity, and security were the main anchors of the scenarios: these areas prove to be excellent grounds to critically reflect on security, technology dependence, and autonomy. We do so by asking whether AAL could not only positive contribute but also contain potential threats to security and autonomy, and, if so, what is the nature of this threat?

Security: The scenarios cover two main aspects of security: (a) the potential to facilitate secure access to (public) services and (b) to provide and increase personal security.

All security technology contributes to and requires a segregation of (potentially) good/bad, before/behind the camera, suspicious/nonsuspicious and normal/not normal behavior. Although this goes generally unacknowledged, the main question must be on whose values, perceptions, and worldviews these judgments are based. The makers of the technology or the users? The mere fact that security technology is seen to be necessary – that it is there and visible for anyone passing by - fosters mistrust and the perception that anyone may be a potential enemy. Outside classical surveillance settings, cameras may be worn by persons: then those who actually feel in need of protection (e.g., older adults) become carriers of intrusive security technology themselves. Fear grows, and ever more security technology is purchased, which is potentially a vicious circle.

The widespread expectation that surveillance is equivalent to actual crime reduction is another aspect which treats technology as something that may directly affect values. Here one has to ask, though, what the difference is between a crime which is committed unseen and one which is broadcast – at the moment of the crime for the victim as well as the aggressor. What is the role of those watching but unable to help? Can they cope with their situation? There seems to be a considerable gap between the hope of ex ante crime prevention and the fact of ex post crime detection.

Technology dependence: allows two different readings: (a) ICT addiction and (b) technology replaces human beings.

Technology users' identities are significantly influenced, altered, and mediated by their use of technology, and one consequence is an ever-increasing (voluntary and involuntary) connectivity and individual availability. Equal individuals are increasingly exposing themselves and/or watching others. This exhibitionism primarily serves to attract (other persons') attention and to emphasize personal individuality and authenticity (Ganascia, 2010). These values outweigh concerns about intrusions into privacy or disturbed intimacy. Human identity is affected and, of course, such new forms of technology-bound personal identification require a certain technological infrastructure, hence making it possible to distinguish between persons who are inside and those who are outside technological worlds. This is underlined by the fact that individuals increasingly depend upon the functions and functioning of technology. This carries different risks of malfunction, and

the responsibilities of this are unclear. The fulfilment of basic personal needs (mobility, purchases, etc.) increasingly requires access to ICT and literacy to use it. The effects of such pervasive technology dependence on options of social involvement as well as its effects on interpersonal and social skills have to be traced. We also need to ask what this means for a widening gap between human assistance and technology solutions.

Autonomy: A broad reading of "autonomy" could be that a person is able to consciously decide what (s)he wants (to do), where (s)he wants to go and who or what (kind of technology) provides support if necessary. If technology makes decisions, e.g., whether a person is able to drive or not, the individual's responsible and conscious decision and action is replaced (e.g., the drive lock in the scenario "The tumbling dice"). If the system fails, whose responsibility is it? This is a profound question, since the delegation of decisions to technology implies that the individual is not only seen as being unable to act but also not expected to act responsibly. It is crucial to ask what implications such technologies have in terms of societal values.

Conclusion

The capability of assistive technology to account for emerging properties and to assess complex situations is limited. We should consider (and insist) that human beings are the ones who ultimately control technology decisions. If decisions are made by technology (ICT, AAL, AmI, etc.), a clear dichotomy between good/bad, desirable/undesirable, etc. has to be defined. These distinctions are algorithms defined by human beings ex ante, and the challenge is to negotiate these valuations and anchor them in profound societal discourses. We need to be able to embed this in a larger context, namely in a common definition of what a society should look like that is worth living in as an aged person. Such a discourse necessarily involves conscious deliberation about fundamental societal values and ethical principles.

The fact that assistive technology is not neutral means that it brings along the values the designers had in mind when developing the respective assistive technology (e.g., Feenberg, 2010). This will become evident if you ask: What problem was identified that was to be tackled by a technological answer? How is it done? Or what seems to be a good and desirable solution for the users? What are the criteria for making this evaluation? Hence it seems imperative that we critically reflect on and increase the transparency of the values that AAL transports and of the specific "idea of man," or more precisely, "idea of the older adult" inherent in a given technology. And after analyzing the technology and the assumptions on which it was constructed, we must pose the questions as to whether and how the use of a particular technology may affect users´ values, world views, ideas of man, and attitudes towards our human and nonhuman surroundings.

References: Page 433

GOVERNANCE OF BIG DATA AND THE ROLE OF TECHNOLOGY ASSESSMENT

Articles from the PACITA 2015 Conference Sessions:

(02) Governance of Big Data and the Role of Technology Assessment

Big Data: Trends, Opportunities and Challenges

Lydia Harriss

Abstract

In 2014, the UK Parliamentary Office of Science and Technology (POST) undertook a suite of work exploring how big data is being applied across a range of areas, including business, health, policing, transport and research. This resulted in a series of nine POSTnote publications (POSTnotes 460, 468-474) that highlighted a diverse range of opportunities for using big data analytics to inform decision-making, as well as a number of potential policy challenges relating to skills, privacy, security and discrimination. This chapter provides an introduction to this work, including recent developments in UK data legislation.

A New Asset for the 21st Century?

Data has been described as "the new oil … a fuel for innovation, powering and energising our economy" (Neelie Kroes 2013). It has the potential to provide insights into the behaviour of individuals, populations, markets and other systems. Governments, businesses and others are increasingly asking how information derived from data can be used to inform decision-making and help to develop and deliver better products and services, improve the efficiency with which resources are managed, and personalise relationships with customers (Box 1).

Unlike oil, the amount and complexity of data being created is increasing dramatically – predictions suggest that the total amount of global data could grow by about 40% year on year for the next decade (IDC 2014). This increase has been attributed to a number of factors including the creation of new data sources such as smart phones, increasing technical capacity to store and analyse data, and rapid adoption of new forms of communication such as social media. It has led to the concept of 'big data' – data on a scale or of a complexity that makes it challenging to use that often requires innovative techniques to extract insights ('big data analytics'). Although there is no universally-agreed definition, big data is typically used to describe data with one or more key attributes. These include data of:

- large volume – for example the petabytes (millions of gigabytes) of data collected each year by the Large Hadron Collider particle physics experiment at CERN,

- high velocity – such as video footage collected by unmanned aerial vehicles on military surveillance missions which must be analysed rapidly to be useful,
- high variety – for example medical records that can contain information in multiple formats such as x-ray images, written GP records and blood test results.

Estimates suggest that use of big data could contribute £216 billion to the UK economy between 2012-17, and generate 58,000 new jobs (Cebr 2012). However, the extent to which the opportunities presented by big data will be realised remains unclear.

Examples of Big Data Applications

- Electioneering – Barack Obama's 2012 presidential election campaign used data from social media and the party's database to look for correlations in past voter characteristics and behaviour, enabling them to build up profiles of potential supporters and target resources more efficiently.
- Product design – Bentley motors has used high performance computing to model components before manufacture, enabling faster product development times, decreasing the number of prototypes required and reducing costs.
- Marketing – An individual's specific internet browsing history and social media profile can be compared with aggregated data about other customers' purchases to see what similar customers have bought and to tailor advertising accordingly.
- Asset management – Rolls Royce collects and analyses data from sensors on its fleet of jet engines to determine when they require servicing.
- Medical research – the UK Biobank contains medical information from 500 000 participants, including data about lifestyle, medical history, biological specimens and health records. It is designed to allow detailed investigation of the effects of genetic and environmental factors on health.

Policy Challenges

Storing, analysing and interpreting these unprecedented quantities of data has a number of policy implications.

Skills

It can be difficult to find individuals with the unusual combination of skills and knowledge required to manage and make sense of big data. This typically includes specialist methodological expertise, computer programming, field-specific knowledge and communication skills. A 2014 survey of UK companies implementing big data analytics found that 77% had difficulty recruiting big data staff, and forecasts suggest that demand for big data staff will grow by an average of 23% per annum from 2013-20 (SAS and Tech Partnership 2014).

Privacy

Big data may have the potential to make infringements of privacy more likely for several reasons. The widespread adoption of devices such as GPS-enabled smart phones, which collect and transmit information about their location, is leading to data being acquired from previously private areas of life. In addition, big data projects often involve re-using data, which may increase the likelihood of original data-usage permissions being lost or overlooked. Projects may also link together different sets of data, which may make it possible to re-identify individuals from data that have had identifying details removed in order to protect people's privacy (Executive Office of the President, The White House 2014).

Security

A range of tools and procedures can be used to reduce the risk of data being accessed and used without permission, including data encryption and implementation of good data governance. For example, making individuals accountable for data security, minimising the number of people with access, and deleting data when appropriate. However, it is impossible to guarantee that data will be completely secure.

Discrimination

There are a number of cases of big data leading to unintended discrimination. For example, it may be used to facilitate differential pricing, where individuals are offered different prices for online products depending on how affluent they appear to be (Executive Office of the President, The White House 2014).

Recent Developments in UK Data Legislation

Use of data in the UK is governed by multiple pieces of legislation, depending on the type of data and the context in which they are being used. The collection, storage and processing of personal information is regulated by the Data Protection Act 1998, which implements the EU Directive 95/46/EC. This Directive is widely recognised as being outdated. Draft proposals to reform it were put forward in 2012, which are still under discussion by the European Parliament and the Council of the EU (European Commission 2015).

Interception of communications data in the UK is governed by the Regulation of Investigatory Powers Act 2000. A 2006 European Commission Directive was incorporated into UK law in 2009, requiring communication service providers to retain communications data for up to two years. This was struck down by the European Court of Justice in 2014, leading to emergency legislation that the UK Government stated was necessary to retain existing powers. The Data Retention and Investigatory Powers Act was passed by Parliament in July 2014. It contains a sunset clause, meaning that the laws will lapse at the end of 2016.

References: Page 434

"If I Only Knew Now What I Know Then…"

Big Data or Towards Automated Uncertainty?

Stefan Strauß

Abstract

Big data seduces us to believe that it is the all-seeing eye of events that have not yet happened but might be computable with a certain probability. A variety of actors is thus digging for gold to enrich their information and knowledge accounts. That the haystack grows extensively around the needle seems to be of no interest, because who needs a needle when the whole haystack is worth a mint? The knowledge gathered by big data can be highly useful in many contexts, e.g. for strategic decision-making, early warning systems, load balancing etc. However, it also entails a number of risks, not least for the privacy and autonomy of the individual. The increasing complexity of big data analysis tied with increasing automation may not merely lead to more uncertainty but also entail unintended societal events. This contribution focusses on the thin line between exaggerated expectations and the underrepresented momentum of uncertainty that correlates with the big data discourse.

Introduction

Big data is often defined as "high-volume, -velocity, -variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making". This definition from the Gartner Group (2001) mirrors the strong role IT marketing plays in the big data discourse as it puts emphasis on presenting big data as a novel form of information processing that efficiently enriches decision making. Less mystifying, Boyd and Crawford (2012) define big data as "a cultural, technological, and scholarly phenomenon" that rests on the interplay of technology, analysis and mythology. Technology refers to maximizing computing and algorithmic power, and analysis to recognizing patterns in large data sets in order to make economic, social, technical, and legal claims. Mythology addresses the "widespread belief that large data sets offer a higher form of intelligence and knowledge to generate insights previously impossible with the aura of truth, objectivity and accuracy" (Boyd/Crawford 2012).

These myths of big data seem to be relatively widespread as a number of enthusiastic claims exist that promise new valuable insights by exploiting large, messy data sets in a natural way based on the belief that "[w]ith enough data, the numbers speak for themselves" (Anderson 2008). This rather delusive view is linked to assumptions that with extensive amounts of data the importance of data quality would decrease. Instead of putting emphasis on accurate data, the identification of correlations is seen as the key for better decision making (cf. Cukier/Mayer-Schönberger 2013). In this regard, a broad scope of options is promised for using algorithmic power to analyse petabytes of unstructured data, which is framed as a panacea for handling complexity and reducing uncertainty. Related to this is the belief that big data paves the way for predictive analytics to allow for predictions about future events. However, the increasing complexity of big data analysis fed with increasing automation may trigger not merely uncertain but also unintended societal events.

The Big Fallacy of Predictability

Big data is closely linked to "datafication" (Cukier/Mayer-Schönberger 2013) which describes the trend to gather large amounts of information from everyday life in order to transform it into computerized, machine-readable data. The main purpose of this datafication is often a pragmatic way of thinking, in the sense of the bigger the better or the more data the better the results. Hence, besides the big data mystique and related trends, there might be a new paradigm of data pragmatism on the rise, as Boellstorff (2013) pointed out: "Algorithmic living is displacing artificial intelligence as the modality by which computing is seen to shape society: a paradigm of semantics, of understanding, is becoming a paradigm of pragmatics, of search." If there is such a shift away from semantics, then syntax might become more meaningful, especially for big data analysis.

To point out what big data is and is not, language translation provides an interesting example. Tools such as Google translator or Babelfish are based on large data sets about terms, phrases, and syntax and use pattern-recognition algorithms. In the end these algorithms calculate probabilities of the gathered textual information based on its structure and syntax. While the results are often far from being a precise translation, in many cases it at least gives some valuable hints to the translation, nothing more, nothing less. The results are sheer probabilities of the original text in a different language. This is often enough to get the basic idea of a sentence, but without solid interpretation it is worthless data. This describes the role of big data quite well: Big data algorithms (such as mapreduce)[1] are most likely to be probability calculating pattern-recognition techniques. The analysis of large data sets can bring a number of benefits. However, the role of profound interpretation increases with big data. If this role is not taken seriously, this can lead to a number of problems, particularly if automated algorithms analyse and interpret information and thus also automate decision making based on pragmatically gathered data.

Correlation is not causation and mixing up correlation and causation can lead to more uncertainty, not just in a sense of risking the creation of inaccurate data but also as regards

taking wrong decisions. This can be particularly problematic if the results of predictive analytics are misinterpreted. Boellstorff (2013) reminds us that "[d]ata is always a temporal formation". Hence, the effective options for predicting future events are naturally limited. These facts seem to be neglected in the big data discourse. Data is also not to be misunderstood with being a synonym for a valid fact. A set of data can be a valid fact, but is not per se. The term "fact" addresses something that is actually the case and, in the words of Ludwig Wittgenstein, "[t]he world is the totality of facts, not of things" (Wittgenstein cited in Casey 1992).[2] Data are first and foremost a set of numbers and/or characters. The fact that data exist does not imply that it are also valid or true in a certain context. This is in particular not the case if the existence of this context lies in the future.

In this regard, together with an increase in automated decision making, big data entails high risks of reinforcing false positives and creating self-fulfilling prophecies, especially if correlation is mixed up with causation as the big data discourse suggests. This is inter alia visible in one of the seemingly "big" success stories, namely Google flu trends, which was celebrated for its highly accurate prediction of the prevalence of flu. However, as Lazer et al (2014) pointed out, in the end the prevalence of flu was overestimated in the 2012/13 and 2011/12 flu seasons by more than 50%. This and other examples underline the seductive power of big data for it to be perceived as a novel tool for predicting future events. Blind trust in the power of predictability of big data can complicate the verification or falsification of the results of big data analysis. A prediction can hardly be verified or falsified if a predicted event is assumed to be true and action is taken to prevent it. The question "Can pre-crime be prevented?" gives an illustrative example for this complication. Or put more generally, to what reality does big data refer if a predicted event triggers action to prevent the event? Considering that the (automated) calculation of probabilities plays a very important role for big data, another question might become more pressing: What happens with rare, unlikely events? Black swans represent unlikely events with a very low probability. But as noted by Taleb's (2007) black swan theory, particularly those rare events can have a high impact.

Big Data, Surveillance and Privacy

The large-scale surveillance practices employed by security agencies on a global scale that Edward Snowden revealed drastically highlight how big data is used for mass surveillance. The released documents inter alia reveal that the NSA collects more than 20 billion communications events each day, which is much more content than the trained analysts can use in their work (Greenwald 2014). While this is worrying in many different respects, it also highlights the fact that complexity increases with the amount of data. Furthermore, there are also risks entailed regarding false positives and to be increasingly prone to errors. Through what Gandy (2012, cited in Lyon 2014) calls "actionable intelligence" and an increase in automated decisions based on algorithmic authority, serious problems of surveillance are likely to be further reinforced. David Lyon (2014) pointed out that there is a supportive relationship between big data and surveillance that exploits personal data and amplifies a number of related threats, such as blurring boundaries between personal and non-personal information, de-anonymization and re-identification techniques (Strauß/Nentwich 2013) and risks of surveillance such as profiling, social sorting and digital discrimination. Not least with developments and trends towards predictive policing aiming at identifying "likely targets for police intervention and prevent crime or solve past crimes by making statistical predictions" (Perry et al 2015), big data entails a number of serious challenges that can even strain the cornerstones of democracy such as the presumption of innocence or the principle of proportionality. Threat scenarios referring to the movie "Minority Report" might be overestimated. However, automated predictive analytics might increase the pressure to act and challenge us to identify the red line between appropriate intervention and excessive pre-emption.

Conclusion

Big data represents a new source of networking power which (as with every technology) can be a boost or a barrier to innovation in many respects. While the results of big data analyses might lead to new insights for decision makers, the flip side might show new power asymmetries where a new data pragmatism celebrating quantity and probability curtails quality and innovation as well as reducing privacy, informational self-determination and the autonomy of the individual. In order to reduce the risks of big data, it is reasonable to reconsider the thin line between exaggerated expectations and the underestimated force of uncertainty that correlates with the big data discourse.[3]

References: Page 434

How Should We Govern the Algorithms that Shape Our Lives?

Robindra Prabhu

Abstract

With the advent of big data, algorithmic systems are poised to influence ever-larger portions of human activity. The rise of the algorithm presents both TA practitioners and policymakers with nuanced and novel governance challenges, yet we often lack the tools and frameworks to tease out the ethical conundrums and the wider social stakes of these developments. This article argues that sound algorithmic governance rests in part on finding appropriate responses to the challenges associated with meaningful transparency, accountability and fairness.

The Rise of the Algorithm

When debating the various challenges related to the big data paradigm, the TA discussion has largely focused on the tail end of the buzzword, namely "data". Such a focus triggers interesting and hugely important discussions about the myriad of data traces left in the wake of our techno-driven lives, the novel pressures on data privacy these create, which fragments we should be able to collect and store and, once collected, how to ensure adequate protection against theft or misuse. While undeniably important, a singular focus on data and their associated risks often fails to capture all the nuanced ethical questions that emerge in the complex big data machinery, many of which are only remotely connected to the data as such, but nonetheless have ethical ramifications and by consequence very real and important policy implications.

In particular, we will argue, there is a need for TA practitioners and policy makers to direct attention to the variety of algorithmic tools in use that help make data a utility. Be it online nudging, self-driven cars, patient risk scoring, credit evaluations, news aggregation or predictive policing — algorithms are quickly becoming more pervasive in society and are rapidly gaining traction in decision-making systems that are subtly weaved into our day-to-day lives. With the advent of big data, algorithmic systems are poised to influence ever-larger portions of human activity, creating unique and distinct governance challenges that the "data protection and privacy" debate will often fail to elucidate. In "The Real Privacy

Problem", Morozov argues that algorithms are starting to infringe on human decision-making processes (Morozov 2013). We seldom understand how they work, but have nonetheless become dependent on them, and afraid or unable to disregard their guidance (Danaher 2014).

Computational systems are certainly not new objects of study in the TA community, having long since become fundamental pillars of modern society. As Manovich puts it: *"What electricity and the combustion engine were to the early 20th century, software is to the early 21st century. I think of it as a layer that permeates contemporary societies"* (Manovich 2013). Yet rapid advances in digital connectivity, machine learning and artificial intelligence, coupled with novel data streams, have both necessitated and catapulted algorithms to the fore. As Wagner et al. remark, algorithms are now integral, or at least supporting tools, in an increasing number of decision-making processes, at times even acting as the sole decision-maker (Wagner 2015). Not only confined to the online sphere, where they regulate the information returned by a search engine or the news feed in our social networks, algorithms are now moving into areas of life where decision-making processes have traditionally been dominated by human judgment. Healthcare, employment, advertising, finance, law enforcement and education are but a few examples.

Peeking into the Black Box and Beyond

The purpose of this paper is not to bemoan these developments, nor is it to praise the merits of algorithmic decision-making systems. The purpose is rather to precipitate a discussion on how the TA practitioner can create a framework for probing algorithms as unique sociotechnical entities and to devise appropriate policy responses for mitigating risks and for harnessing potentials. In particular, the discussion will center on challenges related to transparency, accountability and fairness, all considered important pillars of sound algorithmic governance.

Transparency

To the outside observer, algorithms may often appear to operate subtly and quietly behind the scenes. Opacity can make it difficult to understand precisely how it operates, when it is in use, and to what end it is employed. Moreover, TA practitioners and policymakers may often feel we lack the tools to study algorithms in action, to scrutinise their inner workings, to assess the wider social stakes and to design interventions that help mitigate risk.

As a result, it is easy to denounce algorithmic systems as "black boxes", and a common response to this predicament is to demand more transparency. But how does one bestow meaningful transparency on an algorithmic system?

One gut response for breaking algorithmic opacity is perhaps to ask for access to the computer source code. While source code undeniably gives valuable insights into the workings of an algorithm, many algorithms are proprietary, and there are very real

arguments for maintaining trade secrecy. Third party access to source code is therefore not trivially achieved. And even when access to source code is granted, there are at least two challenges to achieving meaningful transparency:

Complexity: The internal workings of an algorithmic system are often best understood by the developer team. Complexity and interdependencies can make algorithms practically challenging to decipher even for competent third party examiners. In the worst case, "source code" transparency may become little more than symbolic transparency, in much the same way as it may be argued that online notice-and-choice agreements wrapped in tedious and cryptic legal writing do not provide the online user with any real support and choice for making an informed decision. Another instructive analogy is tracking data that cell phone carriers in many countries are required to release to the cell-phone users upon request (Biermann 2011): unless you have the time, knowledge and resources to analyze and visualize such data in meaningful ways, your legal access rights to the data may be of little import and may at worst mask the privacy implications at play.

Values and judgments: Even if the source code can be fully deciphered, the source code alone may not be sufficient to shed light on the full "algorithmic complex". Here it might be useful to examine the parallels with the modern factory assembly line (Gillespie 2014), such as a car plant. Along the assembly line we find a series of robots programmed to execute very specific operations on the input data (a proto-car). In this analogy the source code may perhaps be likened to the technical blueprint of the robot: while it is possible to check that the robot performs its tasks according to its blueprint, it is more challenging to gauge exactly what the orchestra of various robots output at the end of the assembly line simply by studying the blueprints of the individual robots. More importantly perhaps, it is hard to know from the robot blueprints alone how the car will behave on the road with human beings in it and around it. Moreover, assembly lines are seldom void of people. Like the robots, these workers will typically have very specific operational tasks closely intertwined with the operations of the machines (Gillespie 2014), however they do influence the final product in important ways — otherwise, they would not be there. And just as the assembly line is a man–machine system, so too is the "algorithmic complex", in ways that far exceed the source code alone:

1. The algorithm exists to perform a specific task, part of a solution to a wider problem. This problem is defined by people, and its framing may influence the algorithmic output in important ways.
2. Models are created which contain assumptions, choices and simplifications made by people. These judgments may significantly impact the algorithmic output.
3. Embedded in these underlying models, the source code instructs the algorithm to respond in certain ways to certain inputs. For example, the algorithm may be trained and optimized using training data that has been selected and curated by people.
4. The machinery is then fed some input data, which may also have been trimmed, selected or filtered in some way. The operational selection choices are again all made by people.

5. Finally the algorithmic system will output a result that is framed, interpreted and acted upon in a larger human decision-making complex.

At all these junctions there are people involved. And while their tasks are often highly technical, specialized, procedural and focused, it creates a number of entry points for value judgments, arbitrary choice, biases, harmful assumptions and potential discrimination.

In the final output of the algorithmic complex, these junctions are often rendered invisible to outsiders. Meaningful transparency should therefore aim to expose these junctions and the values at play. This requires mechanisms to shed light on the entire "algorithmic complex" as a man–machine system. The governance challenge is to find ways of making this dynamic transparent and to this end, source code access alone will seldom suffice.

Accountability and Oversight

Closely related to meaningful transparency is the problem of accountability and oversight. Especially when algorithmic systems make decisions of import on and in people's lives, a natural regulatory response is to demand someone (or something?) to watch over these systems and hold players accountable when something goes wrong.

As with transparency, such oversight may not always be trivial to achieve, and it brings at least four challenges to the fore:

1. ***Locating agency:*** proper accountability and oversight necessitates some knowledge of who does what, when they do it, to what end and whether it is in line with protocol. But complex man–machine systems like the "algorithmic complex" can make causal chains diffuse and distance the people involved from the wider societal consequences (Gillespie 2014).

2. ***Efficacy:*** Algorithmic systems are put in place to achieve a certain predefined goal, a goal that is often defined by the employing institution or actor. For example a predictive risk assessment of individual crime propensity may be employed with the aim to reduce crime and prevent individuals from pursuing criminal pathways. But how does one measure the efficacy of such systems and weigh them against alternative non-algorithmic practices?

3. ***Uncertainties and side effects:*** Algorithms are embedded in models that are shaped by assumptions, simplifications, human judgment, arbitrary choices, value choices and approximations. How can we ensure that the uncertainties that arise in the algorithmic output are duly accounted for in the decision-making process and that appropriate steps have been taken to mitigate unwanted side effects?

4. ***Recourse and contestation:*** Does the subject of an algorithmic decision-making system have any real opportunity to contest the decisions made? Providing opportunities to contest single and unique decisions, such as a credit risk score or the qualification for a social benefit, may seem straightforward, but how does one provide meaningful actions of recourse against subtle and largely invisible algorithmic decisions that happen behind the scenes and whose effects are only visible after a long time has passed (such as online "filter bubbles").

Fairness

Strongly related to the topic of accountability, but more challenging still, is the issue of fairness in algorithmic systems. Algorithms are often touted as impartial, free of human bias and prejudice, neutral, procedural and hence "fair". In fact these perceived qualities are often given as key reasons for replacing human decision-making systems with algorithmic ones.

But if algorithmic systems are at least partial products of human judgments, assumptions, simplifications and curatorship, can they ever be truly neutral and fair?

Perhaps more so than any other governance challenge related to the algorithmic complex, the issue of fairness is intimately tied up to the issue of framing: what are the goals the algorithmic system is set up to achieve and who are ultimately the intended beneficiaries?

Contrast the following entirely hypothetical cases:

1. Genetic data is used to predict the risk of an infant developing a serious future disease. Early action can potentially reverse this path, lead to better quality of life for the infant and severely reduce costs for the health care system.

2. Genetic data is used to predict the risk of an infant going down a criminal path. Early action can potentially reduce this risk with great savings for society, but will our response to this algorithmic output create real and viable alternative pathways for the infant, or will it be used to fence it off from society?

As with any policy measure, the issue of fairness in algorithmic systems is intricately linked to framing and the wider context of their deployment. Do the systems serve to provide more opportunities, alternative pathways and better services, or do they lead to more discrimination, stigma and exclusion (Stanley 2014)? While these issues are by no means unique to algorithmic systems, they do perhaps raise novel governance challenges in the context of such systems:

a) How do we measure an alleged discriminatory effect? How can we ensure socially and ethically sound algorithmic design?

b) How do we assess unwanted ills that have become ingrained in social systems and are hence silently transferred to algorithmic systems, without explicitly forming part of their design? Without meaningful transparency, algorithms may at worst become formalized systems of discrimination, hiding behind a false garb of impartiality, both propagating and obscuring unfair and unwanted practices.

Summary and Conclusions

With the advent of big data, sensor networks and ubiquitous digital connectivity, algorithms are set to become ever more pervasive in decision-making processes across a variety of fields, ranging from online searches to credit risk scoring, from crime prevention to elementary school teaching, from financial trading to medical treatment. As algorithms become more pervasive in both quotidian and vital decision-making processes, often replacing or supplementing long established human decision-making processes, it becomes ever more important to establish frameworks that can tease out the values embedded in such automated systems. To do so, TA practitioners and policymakers will have to grapple with at least three challenges:

1. Bestowing meaningful transparency on the entire sociotechnical algorithmic complex, exposing points of entry for value judgments, biases, arbitrary choices and human curatorship and by providing methods for evaluating their impact on the final output.
2. Devising tangible mechanisms for ensuring oversight and accountability. In addition to locating agency in a diffuse man–machine system, this may involve devising novel methods to evaluate the efficacy and precision of the algorithmic output as well as identifying unwanted societal side effects. Finally policymakers will need to contemplate methods of recourse and contestation.
3. Ensuring that algorithmic decision-making systems do not become formalized systems of veiled discriminatory practice by establishing mechanisms to ensure fairness and due process.

Developing the tools for probing the algorithms that shape our lives and the frameworks for their good governance is work that merits due attention from the TA practitioner.

References: Page 434

Assessing Big Data

Results and Experiences from Germany

Timo Leimbach and Daniel Bachlechner

Abstract

In recent years, big data has been one of the most controversially discussed technologies in terms of its possible positive and negative impact. Therefore, the need for technology assessments is obvious. This paper first provides, based on the results of a technology assessment study, an overview of the potential and challenges associated with big data and then describes the problems experienced during the study as well as methods found helpful to address them. The paper concludes with reflections on how the insights from the technology assessment study may have an impact on the future governance of big data.

Introduction

During the last few years, big data has gained a lot of attention in scientific and public debates, which were characterised by ambiguities and uncertainties about the technology. There has not only been confusion about what big data actually is and how it works but also about its potential, for better or worse, and its limitations. Moreover, little is known about the extent of its use. Finally, it remains to be seen how the shift from causalities to probabilities and in particular the uncertainties that go along with that will affect the economy and society as a whole.

In Germany, a first technology assessment study focusing on big data was set up in spring 2013. Its aim was to provide an overview of the topic and to explore further research questions and needs. Although the study focused on big data in all its manifestations, special attention was attached to cloud-based offers (Leimbach/Bachlechner 2014). The increasing relevance of shared resources and the omnipresence of the Internet suggested that cloud-based solutions and data marketplaces will play an important role in the future. Moreover, cloud-based offers also allow small and medium-sized companies to take advantage of big data analytics.

In terms of methodology, the study was primarily based on a literature review. The explosive growth of relevant publications required a systematic approach in terms of publication selection and analysis. The literature review was accompanied by a series of semi-structured expert interviews. Mini scenarios were used to shed light on the potential, limitations and impact in areas of concrete big data applications. The scenarios were aligned with future societal needs as they had been identified in the high-tech strategy of the German federal government.

Results of the Study

Based on a technology and market overview, which showed a broad availability of tools as well as a small, but fast growing market, the study analysed the ***general socio-economic potential*** for organizations (businesses as well as public administration), science, citizens and the economy and society as a whole. This encompassed a broad set of topics such as process improvements, innovative products, growth of scientific knowledge, transparency, participation, productivity, economic growth and employment. There are a few studies actually suggesting the existence of those potentials in the context of big data. One of them is a study by the OECD (2013) indicating that businesses using data analytics extensively are more productive than others. An example for new scientific knowledge is Google's forecast of flu epidemics (Ginsberg et al. 2009). This example, however, also shows first challenges, such as the possible over-interpretation of data (Lazier et al. 2014). By and large, big data has much potential but it is difficult to estimate its extent.

Within the scope of the study, mini scenarios were used to ***analyse the potential of big data in specific existing or envisioned applications***. In the area of climate change and energy, the focus was put on the potential for advances in climate modelling and its implications in particular for forecasting events such as hurricanes or for using weather predictions in the context of renewable energy. Personal medicine and improved possibilities for better diagnostics by systems such as IBM's Watson as well as methods for improving the search for new pharmaceutics were in the centre of the analysis in the area of food and health. With respect to the transportation area, the use of big data in the context of smart cities and the potential for savings by means of smart transportation solutions were looked at. Attention to the potential of predictive policing was given in the area of security. Finally, in the broad area of communication, the potential in the context of fraud detection and the use of predictive maintenance in advanced manufacturing were analysed. Overall, all scenarios showed promise, but when the analysis went beyond the level of customer success stories, it became obvious that this potential is connected with a significant number of challenges ranging from privacy and intellectual property rights (IPR) to technological and economic questions.

The insights gained through the mini scenarios allowed challenges to be identified, dividing them into five groups and analysing them.

1. ***Technological challenges*** such as interoperability or data management show that big data is not a mature technology and that much of the technology that is in use needs to be further developed or even replaced by more advanced solutions.

2. ***Legal challenges*** are among the most discussed challenges, in particular with regard to data protection and privacy because of problems related to data anonymisation (Boyd/Crawford 2012), but IPR and liability also pose challenges since it is not clear who owns innovations based on or is responsible for errors caused by data.
3. ***Business challenges*** are relevant because not all the applications of big data entail a viable business case. Moreover, new business models for data markets are needed as well as tools to identify what data is needed, to locate data and to analyse data properly.
4. ***Societal challenges*** posed by big data result from the shift from causality to probability (Boyd/Crawford 2011). Issues of trust and uncertainty need to be addressed because big data analyses are still accompanied by significant rates of failure. Another challenge is posed by the filtered world experience, which is particularly relevant for consumers (Pariser 2011) but in a slightly different way also for businesses. Although big data promises new insights, there are also limitations such as the selection bias or the non-existence of data. Another fundamental challenge lies in the fact that big data can be used to influence people's behaviour without them noticing it. This challenge to personal autonomy is also called nudging and should be a topic of a general discussion on values and ethics (Degli Esposti 2014, Mozorov 2013). Finally, big data also bears the risk of discrimination. Specific groups or persons may be excluded from processes based on the results of data analyses.
5. ***Structural challenges*** such as the issue of the availability of sufficient network infrastructure for the massive growth in data transfer or that of the further development of human capital, especially increasing data literacy, are evident.

Big data does not only offer potential but also poses many challenges that need to be solved in order to realise the potential. This underlines the fact that big data is not a self-sustaining success story. Moreover, particularly the societal challenges show that there is a clear need for an open debate on which aspects of the positive and negative impact are accepted or desired.

Against the background of these results, the study finally identified six areas that need research and action (Leimbach/Bachlechner 2014). Each of the areas contains three to six concrete needs, of which only few can be named here:

- use and business cases (e.g. inclusion of consumer)
- technological infrastructure (e.g. research on new approaches)
- economics of data (e.g. research on the value of data)
- competence and human capital (e.g. need for information/data literacy)
- legal certainty (e.g. clarification of IPR issues)
- security and data protection (e.g. security research, data protection regulation)

Conclusions:
Lessons Learned and Reflections on the Possible Impact on the Governance of Big Data

One of the main problems related to an assessment of big data is clarifying what big data actually is. The term is not defined very well, and most existing definitions are vague. Some definitions are even driven by the hype in the IT market and aim to promote one or another specific solution. On top of that, current big data solutions are often nothing more than relabelled data analytics solutions, which are at best adapted to the needs of large datasets. Another thing that makes assessing big data difficult is the fact that very little information about the most advanced big data applications is publicly available (Richards/King 2013). This leads to problems when trying to derive the general characteristics of big data and forms a barrier when trying to understand big data usage and its impact. Another problem related to the assessment of big data is the heated debate on the massive surveillance practices of the NSA and other intelligence agencies, which leads to an imbalance of positive and negative arguments. This implies two developments. First, the political and public interest in aspects other than surveillance receives little attention. Discussions of other problems are neglected, as are the benefits. Second, since the debate on the NSA practices has added a negative connotation to big data, some of the proponents are already beginning to avoid the term being associated with their solutions. Although, in the long run, this might be inevitable for a technology such as big data, it further increases the current definition problem and makes it even more complicated to identify and assess related technology and areas of application.

Problems such as the difficulty to foresee the future paths of big data's development or the ambiguity of big data as a general purpose technology that can be used in a broad variety of areas with many different perceptions are known from our experience with other forms of technology. This typically leads to controversial discussions because of strong contradictions in perceptions. Approaches to tackle such problems include the assessment of concrete areas of application, anticipatory technology studies or citizen participation. There are, however, several things that have to be considered in particular in the context of big data. One is the intangibility of data and software, in particular the underlying technology and concepts such as machine learning and other specific algorithms. Their selection and composition strongly influence the analysis of data and thus the results and conclusions drawn from them. Consequently, there is a need to understand them and their implications. Another one is that only concrete application scenarios, where current practices and technologies as well as the impact on specific persons can be analysed, allow deeper insight into big data. But there is the risk that technological perspectives or concrete examples only show parts of the full spectrum of potential and limitations. Keeping this in mind and reflecting on research practices are therefore important tasks in the context of big data research.

The implications for assessing big data also affect how big data is governed. In particular its intangible character makes it difficult to understand the mode of operation and the results of big data analyses, which is a problem for effective regulation. Analyzing concrete applications can help us to overcome this problem but it also has its disadvantages. First,

understanding and preventing intended or unintended misuse require insight into the technical foundations. Aspects such as statistical algorithms for pattern recognition or machine learning require a great effort to understand. Second, concrete areas of application may only cover specific sets of potential and challenges. There is a risk, in particular, that issues concerning fundamental aspects such as human autonomy may get lost in all the application-specific details. This is not only already happening in the context of other types of technology but also in the context of big data. The impact of big data is already sneaking into our life through different means such as recommender systems or targeted advertising. Even some of the other new forms of technology such as personal medicine or smart cities rely heavily on big data. This underlines the need for raising awareness and starting a critical discussion of ethics and values in a data-driven society and economy. However, raising awareness requires interested and engaged politicians and citizens, which, given the technical nature and complexity of the topic, cannot be taken for granted. Technology assessment has the potential to facilitate an open and reflective discussion and, in consequence, to contribute to the governance of big data.

Another important question evolving from the intangible nature of data and software concerns the way big data can be governed. In the past, the answer was often enough to use forms of regulation. This always involved finding a balance between too much and too little and between too early and too late. Many of the components used for big data solutions are publicly available. In principle, everyone could start setting up their own application. Understanding the solutions, however, requires skills that are often hardly available in regulative bodies. The fact that the components are, in principle, publicly available does not imply that concrete applications are also accessible. In contrast, many organisations consider the details of their applications as something to be kept secret. The availability of data is the pivotal point that determines the success or failure of big data and, therefore, is a toehold for regulation. However, this would require a unified approach that takes different attitudes and developments such as data protection or open data into account. The intangible nature of data in conjunction with the global character of the Internet, however, also poses problems to this approach towards governance. First, data can be easily copied. Second and strongly related to the first, data can be easily sent from one location to another. Together, these two characteristics make it hard to control the distribution of data with legal means, which are normally bound to geographic regions. An alternative could lie in normative approaches such as the concept of responsible research and innovation. Problems, however, could lie in the acceptance of such approaches within industry and in their global outreach.

References: Page 435

OPPORTUNITIES AND RISKS PRESENTED BY NEW TECHNOLOGIES

Articles from the PACITA 2015 Conference Sessions:

Robotics Technology Assessment: New Challenges, Implications and Risks

A Session Summary

António Moniz and Michael Decker

Introduction

Robotics technology has been applied to a wide variety of sectors and with a higher economic and social impact. In the last decades it has been one of the main elements of industrial manufacturing automation where about 1.5 million robots are currently operating, which means that 4 to 5 million workers are operating those systems. From 2014 to 2016, robot installations are estimated to increase by 6% on average per year. Besides this, in recent years the number of professional service robots has increased enormously in military and civil applications (around 130 thousand units).

Apart from these empirical facts published by the International Federation of Robotics (IFR, 2013), the general discourse on robotics shows an acceptance of the processes of technology development, but new research is needed. In fact, more visions exist about robotics technology. This observation seems obvious in recent discussions about service robots in health sector, where a wide range of expectations are transferred to this type of application from the experiences in industry. Although most robots are in manufacturing, there is also an increasing dissemination in service and field sectors (agriculture, forestry, health, logistics, etc.). In the nonmilitary fields, the sectors that are applying robots for work activities are agriculture, health, construction, professional cleaning, inspection, underwater and rescue. In the coming years it is expected that another 100 thousand of this type of robots (professional service) will be developed and introduced into practice (source: IFR, 2013).

Robot technology already represents an important market with a growing impact factor, both in economic and in societal terms, such as productivity, employment, and working conditions (Frey and Osborne, 2013; Moniz, 2014). However, the reality of robotics appears to be different from public opinion, at least as reflected in media reports which appear to be more grounded in science fiction. At the same time, this type of technology is gaining interest in the TA community, and some TA studies are being done at the national or European levels on robotics, specifically on its legal and ethical dimensions or on issues related to employment and safety. Our hypothesis is that this technology is shaping the way we are related to the work environment and to the integration of autonomous systems in our daily life. The presentations made by van Est and Pfeiffer at the PACITA session made this very clear. This integration also means that strategies are being developed to achieve a continuous increase in productivity. For this reason we would like to discuss the dimensions of these developments, their impact, and the options both from different national and cultural perspectives and from different theoretical and ethical approaches. That was the aim of the session and to a certain extent was achieved by the papers from a wide diversity of countries and theoretical approaches.

Proceedings of the Session

The main questions that were discussed during the session were the following:

- What are the challenges posed by the integration of different technologies that have different aims, such as location sensors, human-machine communication, locomotion and vision systems? Do they apply mostly to logistics, ICT, materials, micro- and nano-engineering, or also to bionics, mechatronics, and other issues? Do they require different approaches (electronic engineering, computer sciences, biology, sociology, philosophy, and ergonomics) depending on the technology? Or on the field of application? Or both?
- Which new implications and risks arise from an intensified use of robots in everyday life? Are safety, liability, and responsibility central elements in the technological development of robotics in the near future? If so, are the social and human sciences prepared to supply new theoretical and empirical information in order to understand the possible alternatives and changes that have to be considered?
- In which way will industrial production change due to the use of robotics? Which new features of industrial robotic technology are emerging and will be standard in the future? Which of these will have clear implications for the way work is organized and will drive new socio-technical changes? Which implications of the implementation of the concept of industry 4.0 can be understood with such possible developments? Are, for example, social robotics used in manufacturing environments (cf. Moniz, 2015)? This type of robot can be defined as those where people interact with the machine and have some degree of awareness of the human in terms of sensing abilities and/or interfaces and abilities to interact and communicate with people. Robots with such abilities are being introduced in a working environment, and the relationship between humans and these social robots (or cobots) evokes also that between the workers and the human resource management strategies in a company (Colgate, Wannasuphoprasit and Peshkin, 1996; Moniz, 2014).
- Augmented reality will be also a component of industrial automation. Which implications are foreseen in terms of the competence building of the workforce and intuitive human-machine interaction (Hinds, Roberts and Jones, 2004)?

- Does the dissemination of automation (in industry, health, agriculture) represent a trend to take humans out of their work environments? What will the working environment of future look like?
- Are there options for alternative designs of work environments, or will the organization of workplaces be determined by technology?

The participants were from different backgrounds and a common discussion contributed to a new perspective on robotics TA. First of all, just recently a series of studies on robotics TA was issued by the TA community (mostly in Europe). However, interdisciplinary studies are still lacking that converge an engineering perspective with that of the social sciences. Literature under this label has been developed by ethics and legal studies, but social perspectives are still not available. In a way, this session contributed to a discussion from that interdisciplinary approach. Sabine Pfeiffer (ISF and University of Hohenheim, Germany) gave a presentation about robotics and the concept of Industry 4.0, its discourse, development and consequences. She introduced some data about the process of automation development in Germany (18 thousand industrial robots bought in 2013, around 8% increase in robots per thousand workers, 25% increase in automation), and underlined that the human experience is still central but mostly unseen. For example, she concluded on this that digital information and computerized manufacturing technology allows for easy, exact replication of manufacturing processes, and automation always aims to replace human labor. However, this is always a societal decision (mostly from the management side, but also with the support of policy makers and, sometimes, with the permission of unions) based on the possible alternatives and not technical determinism.

Simone Ehrenberg-Silies and Sonja Kind (VDI/VDE Innovation + Technik GmbH, Germany), approached the issue of Industry 4.0 by analyzing the future of work and production with a focus on trends and developments triggered by 3D printing technologies. Although several new achievements can be reached with additive manufacturing concepts (rapid manufacturing of one-of-a-kind industrial products or components, specially designed technical elements, and increased production flexibility), there are still factors inhibiting the further diffusion of this technology in industrial production, such as technical operating conditions (e.g., need of constant humidity) and the skills and special knowledge required by operators. Other inhibiting factors are that the quality of components depends heavily on the material used and the additive processes. Also, the process chains in industry have not yet been adapted for the further processing of additive manufactured components. The manufacturing chains are designed for mass production, and there are clear difficulties in shifting them into a new production concept.

Rinie van Est, from the Rathenau Institute (Netherlands), presented a paper on “Robots everywhere,” based on a report by the Dutch TA institute to the House of Representatives of Parliament. He considers robotization as a rationalization process where the potential social gains should be weighed against the potential costs. Usually, the decision-making process is based on pro and con indicators that are simply weighted in terms of the costs. In his opinion, robotics intervenes in social practices through four elements: ICT, the lifelike appearance of robots, their level of autonomy, and humanizing/dehumanizing systems. This last topic also raises questions about human dignity and robot sustainability.

Finally, Mihoko Niitsuma and Audun Sanderud (both from the University Chuo, Japan) presented a paper about a "Proactive Safety System Using Risk Analysis in a Human-Robot Collaboration". They analyzed safety in industrial human-robot collaboration and the definitions of risk. The authors defined risk as a combination of a probability of an event and the consequence of that event. This introduced the concept of risk reduction measures, and then they analyzed the possible responses to the risk. The reliability of safety system is crucial in automated environments. That would mean an increased trust in automation, i.e., a reduction in unexpected robot actions. At the same time, human awareness must increase. In general, the safety systems should not compromise productivity, but that is still a challenge waiting to be solved.

All the presentations were followed by very interesting and constructive discussions that enabled us to understand the TA dimension when robotics is introduced into working environments. The interest for this debate is even larger because the implications of robotics in our daily life are still growing very quickly as a result of the increasing number of industrial robots (still growing with high rates of growth) and the emergence of new service robots and their application in a wide variety of sectors (Krings et al., 2014; Decker, 2012). A growing number of references to robotics are not only found in scientific journals, but also in magazines, newspapers, television, radio broadcasts and official reports.

The public discussion on the social and ethical implications of robots has become one of the most important in the last years (Decker, 2014). It has effects on employment, on the changing contents of work itself, on the possibilities for autonomous mobility, and on bionics and the health sector. Although it started mostly about the manufacturing sector and industrial robots, a large discussion has developed on applications in different professional and service sectors (Brynjolfsson and McAfee, 2011; Frey and Osborne, 2013; IFR, 2013). The need for further knowledge about the robotics technology is not confined anymore to engineering or computer science. It has become essentially an interdisciplinary field. TA now plays a major role in decision making on investment in robotics and attracts interest from different stakeholders ranging from industry to the environment or to political actors.

References: Page 435

Policy Making in a Complex World

The Opportunities and Risks Presented by New Technologies

Timo Wandhöfer, Miriam Fernandez, Somya Joshi, Aron Larsson, Osama Ibrahim, Steve Taylor and Maxim Bashevoy

Abstract

The core of policy making is the use of relevant information. The relevance of information depends on the perspective from which a decision maker looks at a particular policy issue. Hence different actors may use completely diverse information for a similar policy. Current information and communication technologies (ICT) enable the opportunity of accessing a huge amount of data that is created by different actors with varying interests. Within this paper we take a look at the on-going Sense4us project, which is a Framework 7 European Research Project. The project's strategy is the implementation of technical components that are frequently used to discuss ICT challenges, benefits and risks with stakeholders within the political sphere. This paper provides insights of how to make sense of Tweets' sentiment and how to view on policies from different perspectives.

Introduction

Policy is prepared and enacted for a reason – but how do policy makers ensure that all relevant issues and influences are taken into account, and how do they test the policy before it is implemented? There is a vast ocean of information out there, but sifting through it and finding the data that matters seems an impossible task. Within the following section we look at the evaluation of design assumptions before we proceed with practical ICT. The Sense4us[1] project is developing tools and techniques to resolve this challenge. Sense4us is developing//working on search tools to help finding and presenting relevant sources of information and is building social media analytics tools to discover and track what people are talking about that is relevant to the topic of interest. The second part of this paper provides an overview of this research on Twitter sentiment. Crucially , Sense4us is also developing a software modelling tool that helps policy makers assemble the information they have discovered and link it together. In this way the influences and impacts of policy can be investigated, and its likely outcomes identified. Sense4us therefore enables policy makers to discover a wide spread of knowledge, and this in turn helps them to capture perspectives that would normally not be known or taken into account. The last section of this paper provides more insights into the Sense4us research on modelling and simulation.

Technology Assessment: Evaluation of Design Assumptions

Standing at the crossroads of open data and policy co-creation, a critical challenge that emerges is that of understanding participation as it unfolds over time as well as over different forms of power hierarchies. Technological innovation within this context is embraced with rhetorical enthusiasm and seen as a de facto enabler of democratic decision making. When examined through the lens of technology assessment, we see participation in this context as both a political construct and a technological artefact. Our aim is to provide an improved understanding of the gap between what technological innovation makes possible (within the advanced decision support terrain in policy making) on the one hand and the acceptance or openness on the part of decision makers to embrace citizen input within policy processes on the other hand.

The complexity of the data becoming available to us when making decisions is ever increasing. Ranging from sensor data to text, from social media to expert repositories of knowledge, policy makers are grappling with how to make the journey from noise to signal. The challenge that emerges is how to make sense of the open and big data allegedly at their disposal? Citizens and policy makers alike wrestle with how to intelligently filter information according to relevance, relationship and provenance. At once, the endeavour is about sense-making, as well as building trust within the constraints of a participatory exercise. Decision makers are increasingly coming under pressure to be more inclusive and co-create policy with stakeholders, a pressure from both technologists as well as international and regional treaties such as the Aarhus Convention (1998).

Gaventa & Barrett (2012) suggest from their findings that we cannot consider “success of participation” and “level of democratization” to be linked in a linear or progressive manner. While some approaches to the impact of citizen engagement attempt to draw a straight line from individual actions or behaviours (e.g. voice or participation) to policy or developmental outcomes, we argue that intermediate outcomes may be equally interesting.

The concept of eParticipation in decision making has evolved over a number of decades and is by no means a new concept. Based on a literature review of stakeholder (rather than broader public) participation in decision making, Reed (2008) argues that participation approaches have progressed through a series of phases: awareness raising in the 1960s, incorporation of local perspectives in the 1970s, recognition of local knowledge in the 1980s, participation as a norm as part of the sustainable development agenda of the 1990s, subsequent critiques and recently a ‘post-participation’ consensus regarding best practice. Consequently, there is a growing number of research focusing on the development of the widely recognised trend across policy structures suggesting that the status of traditional representative democratic processes and institutions is declining and new structures of governance are emerging (Turnhout et al. 2010).

Recognising the importance of participatory practices in the network society implies looking not only at what happens in formal participatory practices, but also at what happens behind the scenes, in informal practices (Cornwall 2002). These informal practices are not necessarily organised in invited spaces, but are emerging spontaneously and are based on common concerns created by the particular situation at hand (Fung 2006). This relates particularly to the use of social media when framing policy decisions or anticipating their impact.

Analysis of Social Media to Inform Policy Making

Recognising if a policy is well or badly received by the citizens, what elements of the policy are more controversial, and who are the citizens discussing that policy are key factors to support policy makers in understanding –, not only the citizens’ opinions about a policy, but also up to which level the social media dialogues represent public opinion and should be used to inform the policy-making process.

Following this purpose, the research and development of accurate sentiment analysis tools is at the core of the Sense4us project. During its first year, we have investigated the use of contextual and conceptual semantics from Twitter posts for calculating sentiment (Saif et al. 2014b, Saif et al. 2014c, Saif et al. 2014d). This involved running a comparison of the two types of semantics with respect to their impact on sentiment analysis accuracy.

- Results showed that using conceptual semantics (gleaned from term co-occurrence) improves sentiment accuracy over several baselines. Results also showed that adding conceptual semantics (entities extracted using AlchemyAPI) enhances this accuracy even further.
- Accuracy is key in the context of Sense4us since the project aims to provide trustable information for policy makers to support their decisions. Following this goal we also studied the role of stop words on sentiment analysis (Saif et al. 2014a), showing that best results are achieved when using an automatically generated dataset-specific set of stop words. Furthermore, we experimented with a new approach to automatically extend sentiment lexicons to render them more adaptable to a domain change on social media and generated and published a new gold-standard dataset for social media sentiment analysis (Saif et al. 2013).

With respect to the understanding of the users discussing policy in social media, we investigated 8,296 Twitter users discussing policy topics. Their discussions (17,790 Twitter posts) were collected by monitoring, for one week, 42 different topics selected by sixteen PMs from different political institutions in Germany. The left part of the following figure displays the tag cloud of the top contributors’ names. Among these top contributors we identified multiple organisations and news agencies such as ‘Demokratie Report’, ‘Anonymous Germany’, ‘DTN Germany’, ‘Svejk News’, ‘Netz4ktivisten’, ‘TimesDailyNews’, ‘Voice Dialogue’ and others. The right part of the following figure shows the monitored keywords (x-axis) organized by the number of collected tweets (y-axis) (Fernandez et al. 2013).

Figure 15: Top contributors of our sample of social media conversations around policy topics of interests for German politicians

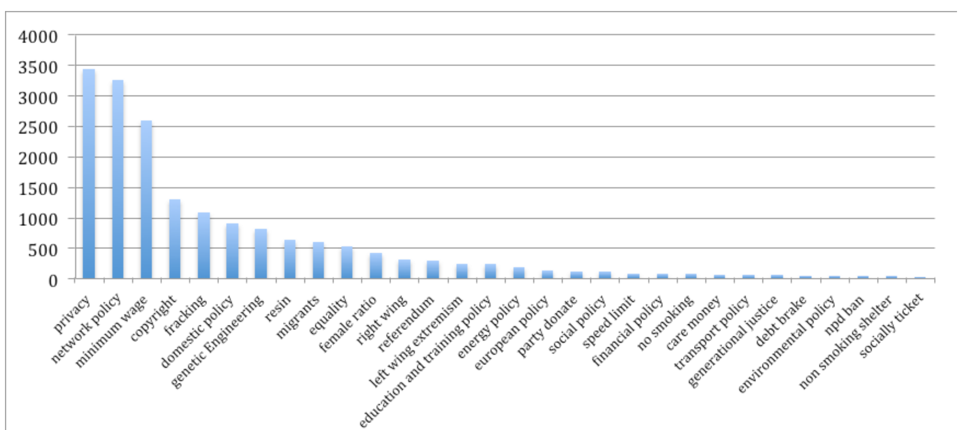


Figure 16: Distribution of posts per topic

The results of this study indicate that: (i) a high volume of conversations around policy topics does not come from citizens, but from news agencies and other organisations, (ii) users discussing policy topics in Twitter are more active, popular and engaged than the average twitter user, and (iii) a small subset of topics is extensively discussed while the majority goes relatively unnoticed.

Modelling and Simulation of Public Policy Problems

We focus on the policy formulation stage of the policy-making process (Lindblom 1968), where problem structuring and impact assessment are carried out at the early stage in the process. The prescriptive impact assessment is a challenge where the effects of a policy are often delayed in time as well as characterized by multiple perspectives, conflicting interests, or uncertainties. To answer these challenges, problem-structuring methods have emerged, aimed at facilitating a better understanding of unstructured problems. The methods rely heavily on engaging with policy makers, adopting a facilitative mode of engagement, and simple, often qualitative models (Franco and Montibeller 2010). The aim of the Sense4us modelling and simulation tool is to support problem structuring, cognitive strategic thinking and scenario-based planning through:

1. Providing an ICT tool for problem structuring tailored for the modelling of public policy problems involving entities such as policy instruments, goals and targets, and actors, where there is an underlying causal map representation (Acar and Druckenmiller 2006) of how changes in instruments lead to change in goal variables.
2. Simulating policy consequences and possible future scenarios on the causal map by quantifying elements of the map (variables and change transfer coefficients).
3. Generating scenarios or alternative policy options based on a forward-looking impact assessment in terms of economic, social, environmental and other impacts. Enabling for decision evaluation of the generated options.

Scenario generation helps policy makers to identify feasible options from a potentially vast space of possible ones reaching stipulated targets, while the decision evaluation can support an in-depth performance evaluation of policy proposals taking the preferences of actors into account. The aim is to provide a policy-oriented software solution that implements a systems approach to structure a public policy problem situation and simulate the system behaviour and responses to interventions over time using a dynamic simulation model, in order to design policy options and assess the consequences given a number of alternative possible futures. Finally, model building also requires access to large amounts of information and means for identifying the elements of the problem model, which is often a constraint for modelling activities. In this respect, it is of high concern to investigate the interface between fast web-based means for gathering and filtering policy-relevant information, such as linked open data searches and sentiment analysis, in order to facilitate the efficient use of a problem-structuring tool.

The following figure shows the decision support framework with the steps of the policyformulation stage of the adopted policy-making process model, as the tasks to be performed by the decision support system, the framework shows the assignment of tasks to the simulator and the multi-criteria decision analysis (MCDA) software modules, also the decision support methods or technologies used for each task.

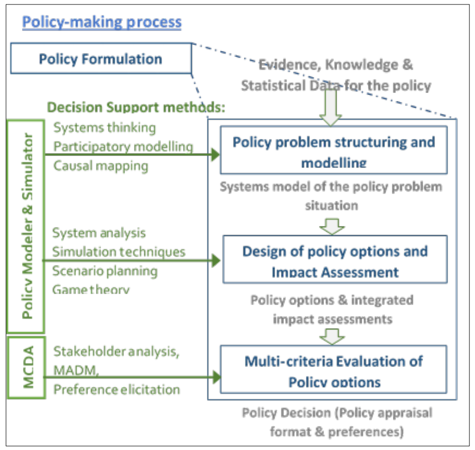


Figure 17: Integration of operations research (OR) modelling and decision-support methods for the three steps of policy formulation

Conclusion

Within this paper we presented information and communication technologies that are part of the Framework 7 European research project Sense4us. The tools' goal is to enable stakeholders within the political sphere to identify online available data related to their policies.

Concerning our research regarding the semantics of Twitter posts, we investigated the use of contextual and conceptual semantics for calculating sentiment. Results showed that using conceptual semantics (e.g. gleaned from term co-occurrence or entities extraction using AlchemyAPI) the sentiment accuracy could be increased over several baselines. Regarding the conceptual semantics, we looked at stop words where the best results were achieved when using an automatically generated dataset-specific set of stop words. Furthermore, we experimented with a new approach to automatically extend sentiment lexicons to render them more adaptable to domain change on social media, and generated and published a new gold-standard dataset for social media sentiment analysis.

The proposed policy modelling and simulation approach allows simplifying and summarising the decision maker's knowledge (notions and causal beliefs) and information gathered from different sources about a social, socioeconomic or sociotechnical system and visually simulates the system behaviour and responses to interventions over time. Large-scale causal maps can be used to model complex policy problems, representing what a government decision maker thinks about the drivers, barriers, instruments and consequences of change achieved by a certain policy proposal. It is obvious that such maps can be useful for analysing, developing and sharing views and understanding among key actors also for creating some preconditions for intervention.

References: Page 436

Factors Influencing Citizens' Attitudes Towards Surveillance-Oriented Security Technologies

Michael Friedewald and Marc van Lieshout

Abstract

This paper deals with the question which factors have an influence on citizens' attitudes towards surveillance-oriented security technologies and their privacy implications. Based on data gathered in a pan-European survey, we discuss which factors determine citizens' perceptions in concrete surveillance practices. We argue that the perceived usefulness of the security practices and the trust in those actors that are promoting and operating security systems are paramount for citizens' acceptance. In addition, individual factors and experiences play an important role for the assessment.

Introduction

The relationship between privacy and security has often been understood as a zero-sum game, whereby any increase in security would inevitably result in a reduction of the privacy enjoyed by citizens. A typical representation of this thinking is the all-too-common statement: "If you have nothing to hide, you have nothing to fear". This trade-off model has, however, been criticised because it approaches privacy and security in abstract terms and reduces public opinion to one specific attitude, which considers surveillance technologies to be useful in terms of security, but potentially harmful in terms of privacy (Pavone/Esposti 2012). In any case insight into the public understanding of security measures is important for industry and politics to make informed decisions and to avoid negative public reactions. Since we have already shown elsewhere that there is no simple trade-off between privacy and security perceptions (Friedewald et al. 2015a), this chapter deals with the question what, then, are factors that affect public assessment of specific surveillance-based security practices?

The PRISMS project[1] has approached this question by conducting a large-scale survey of European citizens. Fieldwork took place between February and June 2014. The survey company Ipsos MORI conducted around 1,000 telephone interviews in each EU member states except Croatia[2] (27,195 in total) amongst a representative sample (based on age, gender, work status, and region) within each country.

Measuring People's Opinions About Security Technologies

Citizens usually understand concepts such as privacy and security in very different ways and often only have a vague idea how security technologies work and what kind and how much information they collect. Thus we first have to operationalize the central terms accordingly.

Privacy is a concept that is not only hard to measure but also difficult to define. It is, however, a key lens through which many new technologies, and most especially new surveillance or security technologies, are critiqued. For the PRISMS work we have used a taxonomy developed by Finn et al. (2013, p. 7-9) who suggest seven different types of privacy that ought to be protected and that receive different attention and valuation in practice. The seven types of privacy comprise: (1) privacy of the person, (2) privacy of behaviour, (3) privacy of communication, (4) privacy of data and image, (5) privacy of thoughts and feelings, (6) privacy of location and space, and (7) privacy of association (including group privacy).

The concept of security is at least as difficult to approach. According to the European Union, "security" can be defined as "protecting people and the values of freedom and democracy, so that everyone can enjoy their daily lives without fear" (General Secretariat of the Council 2010) and is negatively defined as the absence of insecurity. Perfect objective security thus implies the absence of any threat. The discourse in the media and among (EU) policy makers is often narrowed down to issues of terrorism, crime and, increasingly, border security. For the general public, however, security is usually much more, including socio-economic conditions, health or cultural security. Therefore we are using a broad definition, in order not to exclude interesting perspectives. We have identified seven general types of security contexts and the accompanying measures to safeguard and protect these contexts (cf. Lagazio 2012): (1) physical security, (2) socio-economic security, (3) radical uncertainty security, (4) information security, (5) political security, (6) cultural security, and (7) environmental security.

To address the ambiguity and context dependence of the central concepts, the PRISMS survey is working with so-called vignettes that are used when survey respondents may understand survey questions in different ways, due to the abstractness of the presented concepts, their complexity, and because they come from different cultures. Vignettes translate theoretical definitions of complicated concepts in presenting hypothetical situations and asking respondents questions to reveal their perceptions and values (King/Wand 2007).

In PRISMS we have developed eight different vignettes that cover all seven types of privacy. Since our aim is to scrutinize how citizens assess the implications of specific security technologies, our focus is limited to those types of security that are technologically supported, in particular by surveillance-oriented security technologies. This implies that vignettes mainly cover applications such as the fight against public disorder, criminality and terrorism, and also some commercial applications. We have made sure that the vignettes cover virtual as well as physical applications, which are operated by public as well as private sector organisations (see Figure 18).

The vignettes are short narratives of no more than 100 words (the complete text of the vignettes can be found in the annex on the page 437). The vignette about police monitoring crowds was used in two different versions, in the first one surveillance takes place at a football match while in the other participants of a political demonstration are monitored. For each of the vignettes citizens were asked the question: "To what extent, if at all, do you think that [actors] should or should not [do this]" with answer options on a 5-point Likert scale ranging from "definitely should" to "definitely should not".[3]

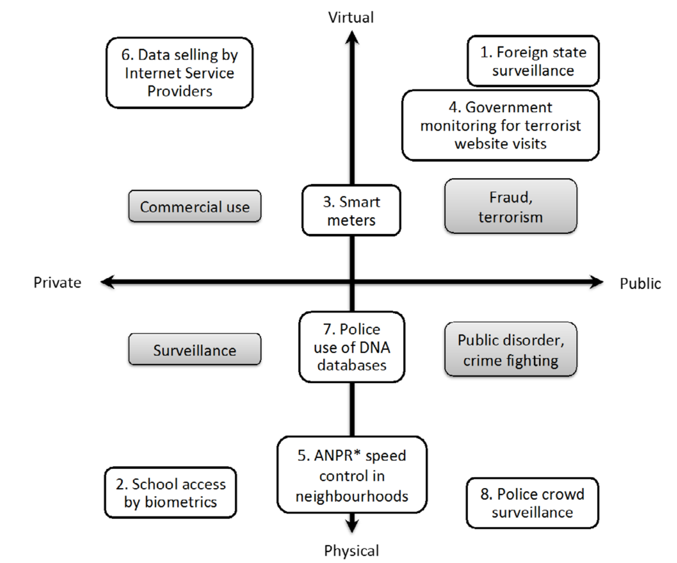


Figure 18: Classification of the vignettes (*ANPR = Automatic Number Plate Recognition)

Descriptive Results

All in all, European citizens are rather critical in their assessment of the security technologies and practices covered by the vignettes. The spectrum of opinions, however, differs widely between the vignettes (see Figure 19).

About half of the vignettes produced a rather clear positive or negative assessment. For instance, more than two thirds of the respondents agreed that "Police surveilling football match", "Automatic number plate recognition (ANPR) speed control in neighbourhoods", and "Monitoring terrorist website visits" should be used to protect security. On the other side of the spectrum, more than 80 per cent of the respondents thought that "Internet Service Providers (ISPs) selling customer data" should not take place.

The rest of the vignettes, however, did not produce equally clear results. While a majority of respondents were still in favour of "Police surveillance at demonstrations" and against "Foreign state surveillance", the remaining three vignettes had about as many supporters as opponents. Especially the usage of smart meter data did not only have almost as many positive as negative votes, it also had the highest number of undecided respondents.

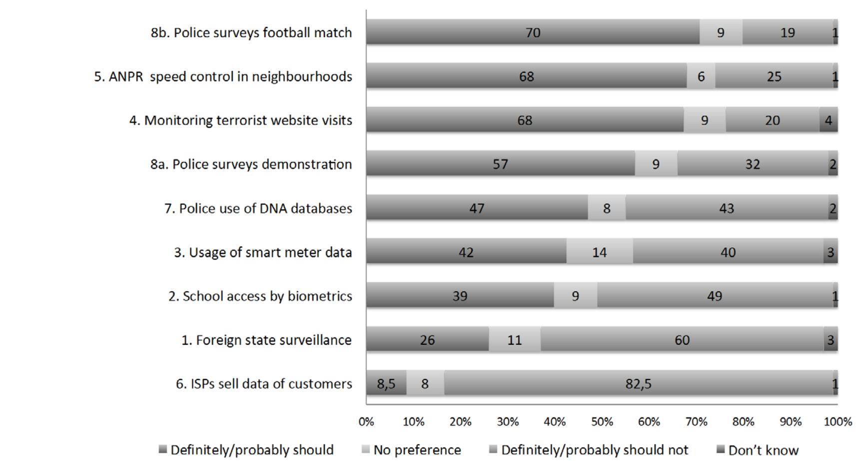


Figure 19: "To what extent, if at all, do you think that [an institution] should or should not…?"

Already on the basis of this basic statistic it becomes clear that there is a distinction between security technologies and practices operated by public and private sector institutions. Even in spite of the obscure role that European authorities (mainly intelligence services) have played in the NSA spying scandal, citizens still have more trust that public authorities do respect their rights to privacy and data protection than profit-oriented companies (which are often branches of multinational corporations).

The figures also show that citizens are especially critical with regard to purely virtual forms of surveillance. There is opposition against covert surveillance practices and secondary use or disclosure of data, especially for commercial purposes.

Identifying Determinants of Citizens' Acceptance

In this section we present results from the analysis of a selection of factors that determine citizens' assessment of the systems/practices outlined in the vignettes. It will show that there is no simple impact of specific factors in the assessment of concrete cases of security technologies and surveillance practices. To answer the research questions and to empirically test our theoretical assumptions, we conducted a series of ordered logistic regressions (a detailed presentation of the regression results can be found in Friedewald et al. 2015b).

The analysis shows that there are only a few factors which play an important role in all cases. Not surprisingly these include citizens' general privacy and security attitudes. Firstly, in most cases there is a strong positive correlation between worries about personal security and support for a security practice. The support is stronger for the cases of physical surveillance than for virtual surveillance practices, which means that people tend to accept security practices when they come close to personal concerns, are understandable, and do not affect

them personally. Secondly, there is an even stronger correlation between privacy worries and the non-acceptance of a security practice.

The third factor that has a significant positive correlation with citizens' support for a security practice is their trust in institutions. It is clearly visible that the perceived trustworthiness of an authority, organisation, or company operating a security system has a positive effect on citizens' acceptance. This supports discussions about the importance of trust for the assessment of risks and benefits and the acceptability of technologies. According to these discussions, trust reduces the complexity people need to face. Instead of making rational judgements based on knowledge, trust is employed to select actors who are trustworthy and whose opinions can be considered accurate and reliable. People having trust in the authorities and management responsible for the technology perceive less risk than people who lack that sense of trust in those members, although some studies seem to suggest that this is not always the case (Bord/O'Connor 1992).

Other factors do not show an equally clear picture and are more difficult to interpret, either because the correlations with the assessment of the vignettes are not always statistically significant or even have effects in different directions.

Gender for instance has a significantly positive correlation in three and a significantly negative correlation in four of the cases. Men tend to reject surveillance practices by public authorities more than those of private sector. This is in line with the fact that, according to our survey, men have less trust in public authorities than in the private sector and less trust in institutions in general than women.

Age is an interesting factor inasmuch as it has been recently shown that the younger generation is not generally valuing privacy differently from older citizens. The assumption that this also leads to a more critical assessment of surveillance practices by younger citizens is not supported by the survey results. Rather, the likelihood that young adults (16-34) found a surveillance practice acceptable is higher than that of middle-aged people and much higher than that of older citizens. This correlation, however, is not significant for all the vignettes. Young adults only found the monitoring of websites in search of terrorists a less acceptable practice. Qualitative research by Székely (2010) suggests that a possible explanation might be that older citizens, who experienced European authoritarian regimes, are more distrustful, whereas younger people, who had not lived in surveillance states, are less concerned.

In general, the survey has shown that the educational level is positively correlated with the valuation of privacy and negatively correlated with the valuation of security. In concrete cases, however, education only seems to have a weak influence on the acceptance of a surveillance measure. For most of our vignettes one can state that the higher the education level, the less likely it is that one is willing to accept a surveillance practice. This indicates that the more knowledge and understandings of the context people have, the more critical they are. These observations, however, are only significant in some of the cases. This is an interesting complement to the findings about privacy since people with a higher education have a significantly higher appreciation for their privacy than those with an intermediate or low level of education.

It has sometimes been suggested that people living in big cities are more worried about their security and thus more supportive to physical security measures than citizens living in small cities, suburbs, or even in rural areas. Our survey results do not fully confirm this hypothesis. Residents of big cities are only significantly more supportive to the vignette on “school access by biometrics”. Their support for the police use of DNA databases is even significantly lower. For all other cases we could not show a significant correlation. The situation is similarly mixed for smaller cities and suburbs. It is in line with the observation that the people least in danger are most afraid. More important than the fear of crime seems to be the perceived usefulness and effectiveness of concrete measures (Verfaillie et al. 2013).

Political orientation has a weak effect on the assessment. Citizens with a left-wing or liberal orientation are less likely to accept surveillance than those who consider themselves conservatives or right wing.

In summary, one can say that people who are not worried at all about being monitored (do not mind being under surveillance) have lower education, are relatively young, and prefer conservative over liberal thinking.

Conclusions

Our analysis of the questions that aimed to measure European citizens’ attitudes towards specific examples of surveillance technologies and practices had the following main results:

- Trust in the operating institution is an essential factor for the acceptance of a surveillance-oriented security technology.
- Openness has a positive effect on the willingness of citizens to accept security practices. This can be understood on different levels: (1) The surveillance activity should not be covert but perceivable for the citizen. (2) Citizens tend to accept security practices when they are addressing their personal concerns. Thus, they need to be convinced that a security measure is necessary, proportionate, and effective. A nuanced and critical view on them is also a question of proper education.
- On the downside it can be stated that many citizens do not care about surveillance measures that do not negatively affect them personally.

Starting from these more general findings, the next step is to define a structural model that describes the relationship of the main constructs in greater detail. This will be a translation of the theory of planned behaviour into a survey-based empirical model. Such an enriched model may then support decision-makers in industry, public authorities, and politics to implement security measures that raise fewer concerns among the population and are thus more acceptable (Friedewald et al. 2015b).

References: Page 436

The Security/Privacy Trade-off

Citizens’ Perspectives on a Politically and Scientifically Contested Concept

Johann Čas

Abstract

The relationship between security and privacy is usually treated as a trade-off. A central premise of the research presented in this paper is that framing the relationship between privacy and security in terms of a trade-off is only one among several potential interpretative frames, and also that it may not be the most common way of approaching the security issue among European citizens. The SurPRISE project developed and applied an innovative research approach to explore these issues, involving about 2000 citizens from nine European countries in participatory technology assessment activities. Qualitative and quantitative methods were used to ensure that citizens not only had a chance to express their preferences among a set of predetermined options, but that they also had an opportunity to voice their own views, ideas, knowledge and proposals. SurPRISE provided a deep scientific understanding of the rationale behind the rejection or acceptance of security solutions and recommendations to increase the appropriateness and effectiveness of security measures embedded in complex social realities.

Introduction

The objective of this paper is to sketch in a condensed form core elements of the research methodology applied in the SurPRISE[1] project and to summarise the main results of this large-scale participatory technology assessment of surveillance technologies (SurPRISE Consortium 2015). It presents recommendations for security measures and technologies that respect human rights and European values and summarises the main factors and criteria influencing the acceptability of surveillance-oriented security technologies (SOSTs).

One of the central objectives of SurPRISE was to question the trade-off approach between privacy and security which largely dominates security policy making and the development and implementation of surveillance-orientated security technologies. SurPRISE challenged this approach from different perspectives: from a theoretical one, which was subsequently empirically tested in large-scale participatory events; from a practical one, investigating technical, regulatory and societal options to eliminate privacy and human rights infringements caused by surveillance technologies; and with a participatory approach, involving 2000 European citizens in the discourse of these issues in informed debates and asking them to express their opinion, to vote on selected examples of surveillance technologies as well as to develop their own suggestions and recommendations on how to maintain or increase security in an acceptable way.

The 16 recommendations outlined in this document are a key output of the SurPRISE project. They synthesize the results from scientific research, the recommendations elaborated by about 2000 participants of the citizen summits and the citizen meetings, the large-scale and small-scale participatory events conducted in nine and five European countries, respectively, and external experts' opinions. The multitude of factors and criteria taken into account by citizens when evaluating SOSTs clearly show that the regular trade-off approach between privacy and security by far oversimplifies empirical reality and should therefore be abandoned in decision making.

Citizen Participation in SurPRISE

The increasing role and use of SOSTs for a variety of purposes is a matter of societal concern, which is evident in a number of public discourses. Although citizens are directly affected by the security and surveillance measures employed in their countries and across Europe, their views and opinions on these issues are widely unknown. To narrow this gap, the SurPRISE project gave about 2000 residents of nine European countries the unique opportunity to express and discuss their perceptions regarding security technologies and their implications at twelve citizen summits. These summits were organised in nine different countries in the first half of 2014 (in alphabetical order): Austria, Denmark, Germany, Hungary, Italy, Norway, Spain, Switzerland and the United Kingdom. The events were full-day public meetings where citizens gathered to have face-to-face discussions about surveillance-orientated security technologies.

The SurPRISE citizen summit method is an innovative technology assessment exercise that gathers both qualitative and quantitative data on the basis of a precise and thorough research design. This method ensures that participants not only have a chance to express preferences among a set of predetermined options, but that they also have an opportunity to voice their own views, ideas, knowledge and proposals during table discussion rounds. The SurPRISE citizen summits provided two types of outcome: (1) a deep scientific understanding of the rationale behind the rejection or acceptance of SOSTs; and (2) recommendations for policy makers and stakeholders involved in decisions on, and the provision of, security-related services and technologies.

The summits featured the analysis of three different SOSTs (smart CCTV, deep packet inspection – DPI, and smartphone location tracking – SLT). The use of specific SOSTs

served two purposes: providing concrete examples for the discussions, and investigating the interrelations between the perceived effectiveness and intrusiveness of SOSTs, and related concerns. To gain deeper insight into participants' opinions, the SurPRISE summits were based on an approach which combined quantitative and qualitative elements. Sets of pre-defined questions and statements clustered around different topics were complemented by discussion rounds relating to each thematic block.

Participants were seated at tables in groups of six to eight individuals, and each table discussion was facilitated by a moderator. The summits comprised alternating quantitative and qualitative phases. The surveys were linked to an electronic polling system that allowed participants to immediately answer the questions via keypads, and the results were presented for each individual question right after the polling. Prior to attending the summit, participants received an information brochure. At the event, before the discussion of individual SOSTs, movie clips were presented to the audience. The clips provided additional information to that contained in the brochures, and were designed to stimulate recall and discussion. SurPRISE produced a short film of about 7-minutes duration on each of the debated SOSTs. Experts from different backgrounds were interviewed and asked to briefly describe the technology, to provide their assessments of the pros and cons, and to address open questions in relation to the corresponding SOST. The mix of written information (the brochure) and more thought-provoking visual information (the film clips) helped equalize participants' knowledge, thus facilitating discussions on a relatively equal footing.

The large-scale citizen summits were complemented by citizen meetings. The main objectives of the small-scale citizen meetings were to supplement the results of the large-scale citizen summits and to apply the SurPRISE approach in smaller, less resource intensive settings. It also served to test the web tool developed to involve citizens in security related decision making. At the citizen meetings the societal context of two more SOSTs, drones and biometrics, and further factors and criteria influencing trust and citizens' concerns about security challenges were investigated. These small-scale citizen meetings were organised in Denmark, Hungary, Italy, Norway and Spain, involving about 35-40 participants per country.

The SurPRISE Recommendations

The recommendations were prepared in several steps, involving a very large number of individuals with varied backgrounds. An essential contribution came from citizens participating in the Citizen Summits and Meetings. About 300 recommendations were developed by approximately 2000 residents from nine European countries. These recommendations were integrated in and enriched by academic research and expertise within and external to SurPRISE and then combined to create the following 16 SurPRISE recommendations:

- ***The legal framework on data processing must meet the challenges of technological advances.*** The current data protection legal framework needs to be adapted and modernised to meet the specific challenges of the most recent data processing tools and techniques.
- ***Enforcing data protection in Europe.*** The impending revision of the data protection legal framework on the EU level and amendments of national law should provide for mechanisms to effectively enforce subjects' rights with regard to data, also when tackling national and public security.
- ***Protect personal data in transit, notably on the Internet.*** Technical and legal solutions need to be adopted to protect data in transit, notably on the Internet, and in particular data travelling outside the European Union and the Schengen area.
- ***Strengthen agencies providing supervision, guidance and control.*** Existing local, national and European supervisory authorities should be organised in such a way that governance is provided by them close to the European citizens and with effective means of enforcement even in cases of cross-border data transmissions.
- ***Implement proper safeguards.*** Any restriction of fundamental rights resulting from the use of surveillance technologies and derived personal data must be based on a stringent case-by-case examination of their permissibility, ruling out untargeted mass surveillance.
- ***Limit the scope of data collection.*** Enable a more effective preservation of a citizen's right to privacy by meaningful enforcement of the principles of purpose limitation and proportionality.
- ***Increase accountability and prevent abuse.*** Stronger accountability and liability for misuse and abuse must be established in both the public as well as the private sector.
- ***Regulate and limit the role of private and nongovernmental actors in the provision of public and national security.*** Security should remain the responsibility of state actors.
- ***Establish a privacy-orientated competitive market.*** Policy makers should provide regulatory acts and incentives to establish a European market where privacy constitutes a competitive advantage.
- ***Implement and improve transparency.*** Member states need to increase their efforts to implement and improve the transparency of policy decisions, of the work of security authorities as well as of corporations and companies, in particular if the privacy of the citizens is affected.
- ***Improve the training and education of security authorities.*** There is a need for more training and education for the personnel of security authorities and stakeholders in various surveillance practices to improve their work in order to act in compliance with privacy and other fundamental rights.

- ***Raise awareness on security and privacy.*** Governments should support all actors in the field of education to reach citizens and educate the population on how new information technologies and, in particular, SOSTs work, and how citizens can protect their privacy and manage their digital data.
- ***Foster participation in decision making.*** Citizens need to be fully involved in the process of policy making, at least at the local and national level.
- ***Establish technology assessment and on-going evaluation.*** Applied TA methods should provide a transparent and participative assessment of available alternatives and should be mandatory and fully included in the procurement and decision-making processes.
- ***Request mandatory privacy by design and privacy by default.*** The integration, maintenance, and further development of privacy by design and privacy by default principles should become a mandatory requirement for the development and implementation of SOSTs.
- ***Focus on the root causes of insecurity.*** Economic and social policies should become an integral element of security strategies; reducing economic inequalities and addressing problems of social injustice are of essential importance for other key dimensions of security and an indispensable contribution to the prevention of violent radicalisation and the loss of political and societal cohesion in Europe.

Criteria and Factors Determining the Acceptability of Security Technologies

SurPRISE developed a very complex and sophisticated model of criteria and factors influencing the acceptability of surveillance technologies and tested it empirically at the participatory events. In the following paragraph selected key results from this analyses (Pavone, Degli-Esposti et al. 2015) are outlined in brief.

Institutional trustworthiness is a key factor determining the acceptability of SOSTs. Besides what citizens may think or know about security technologies, the degree of trust that security agencies and political institutions enjoy is a crucial element that citizens take into account when assessing the acceptability of security technologies. Surprisingly, the perceived level of threat only has a limited effect on the acceptability of SOSTs. Also contrary to expectations, a deeper familiarity with SOSTs does not influence their acceptability. Social proximity, i.e. a personal concern, has a strong impact on acceptability, confirming that security technologies that operate blanket surveillance are considered significantly less acceptable than security technologies carefully focusing on specific targets. Both effectiveness and intrusiveness emerge as highly relevant factors in explaining the level of acceptability of SOSTs, showing that the expected connection with perceived effectiveness has a positive influence on acceptability and with perceived intrusiveness a negative one. Also not surprisingly, a higher concern for both information and physical privacy makes SOSTs less acceptable. However, whilst much of the security technology discourse insists that security technologies need to be intrusive to be effective, citizens argue that the more a technology is considered intrusive, the less it might be considered to be effective. This result questions the general idea that SOSTs need to be intrusive to be effective, and, consequently, also radically questions the trade-off approach. Moreover, the analysis shows that the trade-off approach does not generally influence acceptability, except in the case of very controversial SOSTs, like DPI. Age is positively correlated with acceptability; a result that completely questions the general belief that the younger generation, due to their familiarity with ICTs and SOSTs, would be less concerned with privacy issues.

Conclusions

The results from the involvement of about 2000 citizens from nine European countries in participatory assessment activities concerning SOSTs confirm the scepticism against the trade-off approach in general and, in particular, as providing a suitable guideline for decision making related to security policy. The participants of the Citizen Summits and Citizen Meetings predominantly requested strict limitations and regulations with regard to the use of surveillance technologies. These requests are largely in line with related conclusions and recommendations developed by high level expert groups, e.g. Opinion n°28 of the European Group on Ethics in Science and New Technologies (Dratwa 2014) or the "The Right to Privacy in the Digital Age" report of the United Nations (Report of the Office of the United Nations High Commissioner for Human Rights 2014). The recommendations are also in accordance with core objectives of the upcoming regulation and directive on personal data protection, thus supporting their adoption by the Council and Parliament.

Last but not least the participants requested a more comprehensive, holistic and long-term approach to security, demanding a stronger focus on the root causes of insecurity, i.e. tackling the enormous economic and social injustices resulting from the persistent economic crisis in Europe. In line with expert assessments, high importance is attributed to social and economic risks (World Economic Forum 2014). SOSTs should not replace but only be used in combination with non-technological measures and social strategies addressing the social and economic causes of insecurity. A stable socio-economic environment is an essential precautionary measure not only against minor crimes but also against increasingly violent radicalisation on the level of an individual as well as of the political system. Listening to the voice of citizens would therefore reduce the need for surveillance and thus also lessen the resulting risks for privacy and related fundamental rights, fostering democratic and societal development in line with European values.

References: Page 438

Citizens' Engagement in Urban Security Policy

Potential and Limitations

Peter Bescherer

Abstract

Due to tendencies of social and spatial polarization since the late 1990s, German cities seem to lose their urbanity, i.e. their ability to integrate conflicts and negotiate different interests. This transformation affects the basis for citizens' perceptions of (in-)security. Although they had their share in causing the problems in the first place, local governments are aware of the current challenges. For them, one way of coping is the expansion of participatory options in policy-making. However, as critics have argued, it is hard to decide whether this kind of participation is a genuine democratic input or another form of control. Based on a sketch of recent urban developments, I discuss empirical findings relating to citizens' engagement in the field of security policy. The aim of the empirical research was to understand how security is produced and distributed throughout urban areas, and how people perceive and affect local security policies, e.g. the installation of new technologies or the re-shaping of public spaces.

Introduction

Urbanization during the last two decades was shaped by two different trends. Western cities increasingly became sites for capital accumulation, its social side effects, and its crisis (Harvey 2012). Simultaneously, programmes for more participation in urban planning were rolled out (Becker 2011), in particular referring to security issues (Wurtzbacher 2008). The empirical relation between both trends has been the focal point of empirical research.[1] One of the key questions is if and to which extent citizens' movements resist or counteract – or support and foster urban security politics. There is also an ethical issue involved: Does justice as moral value or principle play a role in municipal security politics? And if so: in which way? Do citizens' movements refer to alternative claims of justice?

Our research is based in two German cities (Stuttgart/Wuppertal). We conducted interviews with representatives of the local Ordnungspartnerschaften, departments that are based on the concept of American community policing. Moreover, we interviewed people who are involved in different forms of citizens' engagement. The third section of this paper presents some impressions from empirical fieldwork, while the first is about the social structure underlying the perceptions of (in-)security and the second gives a summary of research on civic engagement and urban social movements.

New Terms of Urban (In-)Security

The city as we know it today was formed during the 19th-century industrialization. It evolved in parallel with a conservative discourse based on the fear of the 'dangerous classes' and the loss of the traditional community, but also with a progressive discourse stressing the integration of strangers and the acceptance of different lifestyles. From the very beginning, there was a fundamental connection between the modern city and the concept of (in-)security; the whole idea of urban life is about uncertainty and insecurity. Cities are places of insecurity, but they also create a particular urban competence to cope with it. Following the French sociologist Henri Lefebvre (2003, p. 117), "the city creates a situation where different things occur one after another and do not exist separately but according to their differences." That does not only mean that there are lots of people with different social, political, and cultural background in the city. In the broader sense, it also refers to the complexity of the infrastructure for traffic or energy supply and the operation of huge technical facilities. Thus, on the one hand, there are plenty of reasons for urban insecurity. On the other hand, the city creates an implicit framework to deal with insecurities. People who live in a city constantly shift between areas of bonding relations, that is their neighbourhoods, and areas of bridging relations, that is the city's public spaces where they face strangers and act in a more functional way (Préteceille 2013, p. 31). Moreover, cities are centres of economic and political power. Therefore, conflict and negotiation of interests are basic conditions for the city life.

Social integration of the European cities during the post-war period was everything but perfect; think of the exclusion of the poor, migrants, and non-conformist groups. However, during the "golden age" of Fordism (Marglin/Schor 1991), the urban competence in accepting and handling insecurity could hardly manifest. It withered away under the pressures of the "disciplinary society" (Foucault 1977) and the mono-functional arrangement of urban spaces. What remained of it has become seriously endangered by the tendencies of social and spatial polarisation since the late 1990s – increasingly being intensified by recent economic and financial crises. Cities are hit by increasing social inequalities: particularly between the years 2000 and 2006, the percentage of low-income earners in urban regions of Eastern as well as Western Germany was rising (24% and 5%); and likewise was the share of high-income earners (4% and 10%). In contrast, the middle classes were shrinking (9% and 4%). Although weaker, the trend continued between 2006 and 2010 (Gornig/Goebel

2013, pp. 62–63). Since the early 1990s, rents in German cities rose by 62% (Holm 2014, pp. 15–19), and the number of homeless people is expected to climb up to 380,000 in 2016 – which would be 33% higher than in 2012 (BAG Wohnungslosenhilfe 2013). In summary, the dramatic changes in social structure very likely alter the basis for people's perception of security and insecurity.

Participation in a Post-Political Age

Based on a somewhat simplified classification, there are two prevalent kinds of participation: social movements and civic engagement. Social movements have a diverse and rich history, also and especially urban social movements. It dates back to the actions of the 18th century "city mob" (Hobsbawm 1959, pp. 108–125) that show some similarities to recent revolts in France or the UK. Later, the working class organized rent strikes and brought up the "housing question" (Engels 1872) that was also at the core of the European squatting movement in the 1980s. Finally, the movements of the 1960s demanded for a right to the city which became the umbrella term for social urban movements today. Civic engagement is a more recent phenomenon. In Germany it became popular during the government of the social democrats and the green party at the beginning of the new century. Since then a lot of activities were launched by the authorities to support this type of citizens' participation (Bode et al. 2009).

Research on political activism shows that during the past decades, protest and engagement have lost ties with big organisations, such as unions or the church. And therefore the forms of participation are changing, they take a more direct and short-term approach. While social movements often take a stand for their interests by performing direct and provocative actions, the concept of civic engagement covers a wide range of political, social, and cultural activities that are in favour of the local community (ibid., p. 27). Since 1999, civic engagement has been measured by the German Survey on Volunteering (BMFSFJ 2012). In 2009, a total of 36% of the German people were involved in voluntary organisations, first of all in sports clubs and, by the way, hardly in law and crime issues (0.7% of the respondents in 2009). Men from the upper middle classes and well-educated people were over-represented, at least in organized forms of civic engagement.

As outlined above, cities have to face multiple challenges (structural change, polarisation, etc.). Local governments are aware of the difficulties and react by expansion of participatory options. However, usually this participation does not produce an open discussion of urban development issues, but on the contrary, it reinforces the difficulties. Many of the 'formal' participation offers fit into the model of post-political urbanism, as defined by critical geographer Erik Swyngedouw (2009). It presumes a dialogue at eye level where, in fact, the framework of local politics is already laid down and participation hardly means more than to co-decide purely technical questions. Generally, the conceptual approach of citizens' participation often seems outdated, since it is driven by the idealistic notion of a well-integrated and harmonic city life (Holm/Lebuhn 2013 p. 210).

Empirical Findings

What results from the empirical fieldwork we did so far? To begin with, the interviews in both cities show the increasing importance of citizens' involvement in local security politics. In the context of community policing, crime prevention became an activity that is not only provided by the police, but by a wider network of police, local authorities, and the citizens. And, moreover, it was broadened from the emphasis on crime to other security issues (van Ooyen 2006). The starting point, however, is subjective security, as one respondent from the Soziale Ordnungspartnerschaften Wuppertal confirmed: "Someone tells me Yes, I'm afraid of this and that. Or I feel unsafe. That's what I have to face during work every day." According to our interviewees, subjective security is very different among the city districts, depending on factors such as age, income of the residents, or the share of immigrants in the city district: "If in [District A], two teenagers are standing in the streets with a bottle of beer, then for the people there hell breaks loose. [...] If the same thing happens in [District B], people would rather ask where the other 15 teenagers are today."

From the perspective of the Soziale Ordnungspartnerschaften, citizens play a crucial role for security in terms of restoring social control: "I appreciate it if people pay attention, for example, if there's an unknown car in the neighbourhood with someone watching all the time. Or if someone wasn't around for a while. Or report people for doorstep selling. This kind of things." We also find proof for the ambivalence of citizens' participation that ranges between improved democracy and post-political urbanism. Involvement of the people is also a way of assigning responsibility for security and safety: "Crime prevention is a task you can't make others accountable for, but you have to manage it by yourself". Security is no longer a matter of collective coverage provided by the state, but an individual duty largely ceded to the power of the market. Apart from all the respectable reasons for citizens' participation, there are also concerns that volunteers might substitute public services, as conceded by one of the interviewees: "I'm not a big fan of it, but of course there is this idea of volunteers filling the gaps of the underfinanced services in the public sector."

In many respects, participation proves to be more or less post-political. That means procedures and purposes of participation are predetermined. Such as in the case of a group of skaters in Wuppertal who were said to be a threat for elderly people. From the very beginning, the round table that was supposed to solve the problem assumed a security issue here instead of, for example, a claim for public urban space. Moreover, participation only includes conventional forms of involvement. Due to the fact that skaters normally do not form parties or unions, the authorities had no idea how to approach them. Another example for the post-political nature of participation refers to concepts of local area poverty reduction. In both cities the hotspots of community policing are at the same time districts supported by the government because of high unemployment and poor housing conditions. The Social City programme the governmental support is based on assumes a strong connection between security and social cohesion. Therefore political conflict seems not exactly welcome.

We also conducted interviews with citizens' groups and social movement groups independent from community policing. They address security issues outside the scope of crime prevention and they do so with a different approach. A group of squatters in Wuppertal struggles for more societal security, described in terms of social control. But for them, social control is fundamentally related to social equality while the Soziale Ordnungspartnerschaften basically accept the existing social inequality. The squatters therefore refuse the predominant forms of participation. So does a citizens' group in Stuttgart that is campaigning against cell towers which they consider a health threat. They made their own disappointing experience in participation: "We had a meeting with the mayor and his entourage once. We take you and your fears seriously in order to charm them away. That's how they welcomed us."

Conclusion

In summary, unlike community policing in the US, the German Ordnungspartnerschaften do not globally turn societal insecurity into crime prevention. That is also the result of recent surveys: People fear increasing living costs much more than crime (R+V 2014). Moreover, certain community policing measures are rejected by the authorities, in Wuppertal more than in Stuttgart. For example, the respondent from Wuppertal questions video surveillance because "so far no one has proved it can prevent crime" and refuses stop-and-frisk methods by the police because "it's a short step to harassment". To be sure, there is a certain kind of securitization in favour of middle-class needs, as in the displacement of subcultural groups, beggars, or homeless people. The crucial point here is "the role of Stuttgart as industrial location, the feel-good factor". Therefore they "take actions that cause some kind of displacement. If at a certain location this group [homeless people] is disturbing, we try to somehow relocate it".

But, in fact, our research shows that the local authorities address, to a certain extent, social insecurity and the social root causes of insecurity as an autonomous issue. That is also on the agenda of many social movement groups, although with a more structural focus. Therefore, I think, chances for Ordnungsparnterschaften to learn from social movement politics and for social movement groups to improve predominant forms of participation are actually not that bad.

References: Page 438

PART III

TECHNOLOGY-ASSESSMENT METHODS AND CONCEPTS

VARIETIES OF TECHNOLOGY-ASSESSMENT PRACTICIES

Articles from the PACITA 2015 Conference Sessions:

(06) Technology Assessment in East Asia: Experiences and New Approaches
(09) Soil Technologies: A Need for More Responsible Soil Management
(24) Horizons and Incentives of Technology Assessment
(27) Teaching, Learning and Engaging in, through and about Technology Assessment

Underestimated Assumptions and Contexts of TA Theories and Practices

From the Experience of Transition Economies

Lech W. Zacher

Abstract

Substantial experience has been gained with technology assessment (TA) theories and their subsequent practical use, especially in the United States and Western Europe. This experience is conditioned by multiple factors and culturally embedded, which is often overlooked in academic debates and practical recommendations. In some other countries or regions this can result in the absence of TA and/or its ineffectiveness. An investigation of the existing contexts and conditions has to precede any elaboration of TA strategies in government, business, and consumers spheres. A retrospective analysis is also recommended. This demonstrates a good dependence on the past.

The introduction of TA (concept, methods, procedures, institutions) is rather difficult in non-leading countries. The experience in Poland is presented here together with a list of contexts, conditions, obstacles, and barriers. Particular explanations and interpretations are also included.

Empirical views of the economy and society make it possible to propose generalized theoretical postulates. They aim to cope with the associated complexities and diversities, multiple structures, networks, and feedback to achieve synergetic effects. Consequently, a structural approach and the appropriate form of TA are suggested, especially from the perspective of sustainable development.

Contexts and Their Impact: Listing and Interpreting

Multiple types of differences (e.g., economic, political, social, mental, and cultural) undermine the optimistic universalism of TA theories. The elaboration of TA models and strategies and the evaluation of their potential require many different indicators to be taken into consideration (quantitative and/or descriptive). There are numerous examples: GDP level and pace, high tech sector, military industry, R&D expenditures and strategies, economic structure, innovativeness, structure of interest groups and lobbying, external influences (globalization, TNCs), governmental political will, business attitudes (CSR), social valuation of technology, and quality of life (including working life). There are psychological attitudes, such as reactive vs. proactive or short term vs. long term (the latter is increasingly important when sustainability is at stake).

Even in the European Union (EU) there are different conditions and specific problems both in the countries in the core and in the periphery. TA, broadly understood, can help facilitate cohesion and modernization. However, at all the levels of TA theory and practice, matters such as consciousness (sensitivity), knowledge (comparative information), and imagination (visioning) should be carefully considered, weighted, and measured (which can be called technology governance accountability). The application and performance of TA approaches, methods, and procedures depend fundamentally on these features in government, business, and civil society. In transitional economies (e.g., the EEC) this is conditio sine qua non of TA success.

TA obstacles and barriers still exist in the economies and societies of the EEC. A good case is Poland (with 38 million inhabitants). This country has a solid record in GDP growth, privatization, and social transformation. However, there have been rather limited advances in R&D, innovation, structural changes toward high tech industries, technical infrastructure, and its functioning. TA is not well-known or practiced at the government or business level. There are various explanations and justifications for such a situation. Some are historical such as inherited backwardness. After more than 120 years of occupation by Russia, Prussia, and Austria, it currently occupies a semi-peripheral position in Europe. Poland has suffered economic and social devastation and human losses (intelligentsia, in particular) caused by the world wars, the great depression, and oppressive Soviet dependence (including technological and scientific). The country has a poor technical infrastructure, path dependence, and developmental inertia (e.g. Zacher, 1989; 1996;2012b).

There are many more important conditions and factors that have led to the present situation. There are the following:

- low technological levels in certain sectors (industry, agriculture, services)
- structural lack of innovation (due to the economic structure, mostly SMEs)
- lack of high tech industries
- underestimation by politicians of the role played by science and technology
- little social understanding of technology (consciousness, tech culture)
- lack of scientific and technological discourse in media
- lack of technological discussion in Parliament
- traditional values dominant (in originally peasant society, where technology is viewed as a threat)
- traditional education dominant (humanities in excess) and monodisciplinary research
- lack of future studies and prospective thinking
- weak political elites (mostly historians, lack of engineers)
- politically weak technological elites

Some additional disadvantages are connected to the period of Communist rule (45 years long):

- closed economy, weak international cooperation
- limited technology transfer (Western embargoes, COCOM; inappropriate technology from the Soviet Union)
- backward economic structure (heavy industry, coal mining)
- excessive secrecy in military sector (no spin–off)
- “socialistic” cult of the working class and physical work
- centralistic mentality and decision–making
- lack of democracy (no real NGOs)

The aforementioned obstacles and conditions have exerted a strong influence on the present situation in Poland (past dependence) and the possibilities of transformation. Although this can be investigated well by both retrospective and anticipatory TA, this is currently not the case.

There are many negative effects from the past, such as investment trouble (in spite of EU aid) (e.g., metro, nuclear power plant, highways, high speed trains, gasoport):

- the country’s lack of its own advanced technical experience
- low level of technological exports
- technological dependence on FDIs (import them)
- insufficient car transportation safety
- low demand for innovation (structural, domination of SMEs)
- low level of innovation (foreign companies have their own labs abroad)
- laws are not conducive to innovation
- small middle class
- lack of engineers in politics and authority figures
- politically influential traditional workforce (miners, farmers)
- emigration of young educated (more than two million recently)
- difficult and delayed transitional reforms
- political populism; political rhetoric in official documents and narratives (illusory)
- naïve belief in omnipotent invisible hand of market
- limited impact of the green movement, NGOs, etc.
- citizens’ ignorance of and opposition to technology and investment locations (factories, highways, GMOs, biomedicine, etc.)
- sustainable development (imposed by the EU) is politically treated as a threat to sovereignty (e.g., CO_2 issue)

Many more obstacles that need to be overcome can be listed, such as a still statist mentality, excessive political and social emotions (ideologized), insufficient number of expert assessments of controversial matters, traditional Catholic Church’s questioning of “rotten West” patterns, illegal foreign lobbying, and widespread corruption, ignorance, irresponsibility, and shortsightedness. The methods of investigation from impact assessment can be helpful in ameliorating the thinking, decision-making and actions of politicians, business people, and citizens (also as consumers), but these methods should be taught and popularized.

Impact assessment – e.g., economic, environmental, social, and psychological – such as that based on the methodology of A.L. Porter et al. (1980; 1998) may improve the overall process of Poland's modernization (and other transitional economies and societies). It may also overcome the so-called shallow modernization syndrome which has dominated until now. There are still many positive chances and stimuli, not only the technological ones. Some new approaches are necessary in order for both the diversities and the specificities of transitional economies and societies to be taken into consideration.

Sustainability, Politics and Society: Some Generalizations and Postulates

Underestimation of the contexts and specificity of a domestic situation (in Poland and other transitional areas and LDCs) leads to rather disappointing effects in spite of political propaganda and real ameliorative efforts (and significant money from the EU and other international institutions, UN programs, etc.). Evaluations are usually based on deadlines, final effects, the adherence to standards, and spending investment money in the foreseen time. What is underestimated in planning and performance are quality (e.g., sometimes newly built highways need immediate repairs), possible delays (due to bankruptcy of contractors and subcontractors and other factors), problems with stakeholders (especially local, protesters, greens), and unfinished investments (for many reasons).

The real reasons for many failures (of various kinds and scales) are not properly disclosed or interpreted in political and public discourse. They are not merely misfortunes or accidental cases. They are connected with and conditioned by structural factors and gaps. This is characteristic of transitional economies and societies (e.g., Poland, LDCs). This is often not taken into consideration (or at least not sufficiently) by academics from high tech countries which are producers of cutting-edge technologies (including eco-tech) and leaders in the global market. TA policies and activities in such countries are based on different levels of potential and experience in technology and knowledge, as well as of resources and competence. Their TA models, procedures (e.g., parliamentary TA), public knowledge and perceptions, and business and managerial practices are consequently specific to a great extent and not fully universalistic. International academic discussions however often suffer from a presumption that problems and solutions are similar. This is also true of international academic publications. Unique factors and differences are underestimated or even overlooked both in theory (often profiles on abstract or high tech societies) and in practice (political decision makers are reluctant to admit the existence of barriers, gaps, impossibilities, and failures). The TA concept and its implementation strategies must be adapted to the existing context and potential of a country. This is not a marginal adjustment, but a structural one.

It seems reasonable, therefore, to propose a structural approach to an appropriate application of TA in the less advanced countries, such as those with various technological, educational, industrial, and cultural deficits. In depth recognition of technological, economic, social, political, and cultural structures, as well as those of accessible resources and international cooperation and exchange is a prerequisite both for a proper selection of areas for TA (defining

priorities, proportions, linkages, networks, feedbacks, and synergies) and for appropriate TA types, methods, and procedures. An immediate recommendation is to not include all areas and to not use inappropriate TA types. Of course, TA is understood broadly here, as a cognitive- and practice-oriented evaluation of various technologies (e.g., production, informational, military, medical, and educational) and of technology-driven processes, phenomena, and situations. The policy-oriented nature of such evaluations is evident. It may, however, aim at legal action, government strategy and action, and human (citizen, consumer) behavior.

Perhaps it would be better to use the term impact assessment (IA) in place of TA, especially in the broader context of sustainability. A "body" of investigations would then be a structurally driven IA. The impact may be multiple, diverse, complex, interdependent, and networked. The typology is analogous to TA. The type of impact and interaction can, for instance, be scientific, technological, environmental, psychological, social, political, international, or organizational. They are different in various economies and societies. This should be analyzed by a structural approach. Structural impact assessment can show both structurally driven impact and the effects of structurally oriented policies, activities, and behavior. This is illustrated in a conceptual scheme in Figure 20. Structural action is important for countries that desire to change and to promote structural progress in their technology, economy, society, and employment situation. Feedback between past and present structures (e.g., industrial, urban, educational, mental) and TA-type actions may be negative. Results can be either negative or synergetic.

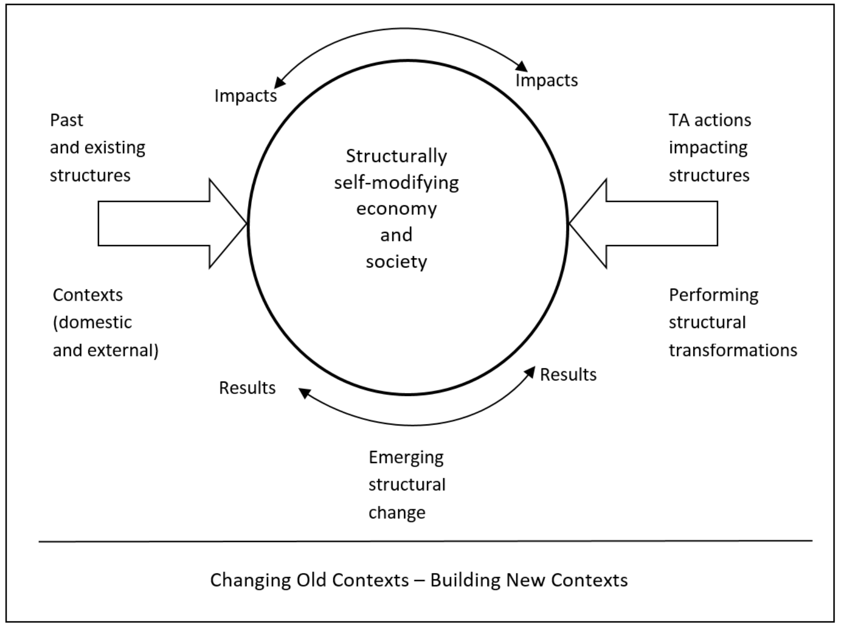


Figure 20: TA Action towards a Structural Change: Conceptual Framework

Much depends on a country's stage of development and its characteristics and on the available TA means and methods. The latter should be appropriate (not only in a Schumacherian sense, see Kumar, 1981; Gamser, 1988). In spite of similarities and the exchange of knowledge in academic circles with regard to the universalization of technology, technology transfer, and the global spread of patterns in many fields, the same technology is not necessarily applied the same in different contexts, and the different applications do not create the same results (and not at the same time, costs, quality, or effectiveness). Appropriateness should be wisely tailored and may be ambitious, forward-oriented, and employ external experiences and help. Exact imitations in technological applications are usually not effective or successful.

Appropriate TA (or rather technology governance) is proper depending on the stage of development and the strategies used (by government agencies, businesses, consumers). Different technological solutions are needed in the case of evolutionary modernization than in the case of radical technological and structural change (i.e., revolution). Such revolutions in the technologically leading countries are first connected with the R&D sector, innovations, and their practical applications and dissemination. In the non-leading countries, however, the technological jump is connected more strongly to technology transfer and technological improvements, and to introducing them into practice (historical cases are Japan and later South Korea). Having the proper technologies is not the only essential condition of success; others are proper management, procedures, institutions, networking, and public involvement. Structural and other appropriate approaches are fundamentally important in virtually all areas and stages. This is especially crucial when sustainability – understood in a complex and comprehensive way – is at stake. Figure 21 presents a conceptual framework which can be instrumental to this end.

Proper (appropriate) technology governance is bound not solely by the types of technology involved, their "nature", specificities, and management requirements, but also by public involvement. This is vital and difficult in democracies that demand public debates, citizen experts, deliberation, and participation in decision making (e.g., in nuclear energy, GMOs, climate change technology). The non-leading countries can learn much from Western democracies; however, imitation of some of the patterns and solutions seen there may be not possible or effective (i.e., inappropriate). Even if political systems, mechanisms, and traditions are diverse (e.g., in China, South Korea, African countries, Belarus, Russia), good experiences and good practices may be found that can serve as inspirations for technology governance (see Mejlgard/Stares, 2012; Rohracher, 2007; Banse, 2007).

In the context of sustainability – broader than TA and impact assessment – there are also significant matters such as transitionality. Transition management should not be treated as business as usual (see Loorbach, 2007). Another requirement is connected to prospective thinking and managing (see Porter et al., 1991), long-term transformative change (Grin/Rothmans/Schot, 2010), vision assessment (Grin/Grunwald, 2000) and new possibilities created by the information revolution's digital state (Pont, 2013) and the big data revolution (Mayer-Schönberger/Cukier, 2013). Information-driven revolutions produce radical new opportunities for gathering data and using them in decision making (by governments,

businesses, and citizens). The digital future (see Zacher, 2015) should be viewed as a challenge and opportunity that will contribute to the success of the sustainability revolution (Edwards, 2009).

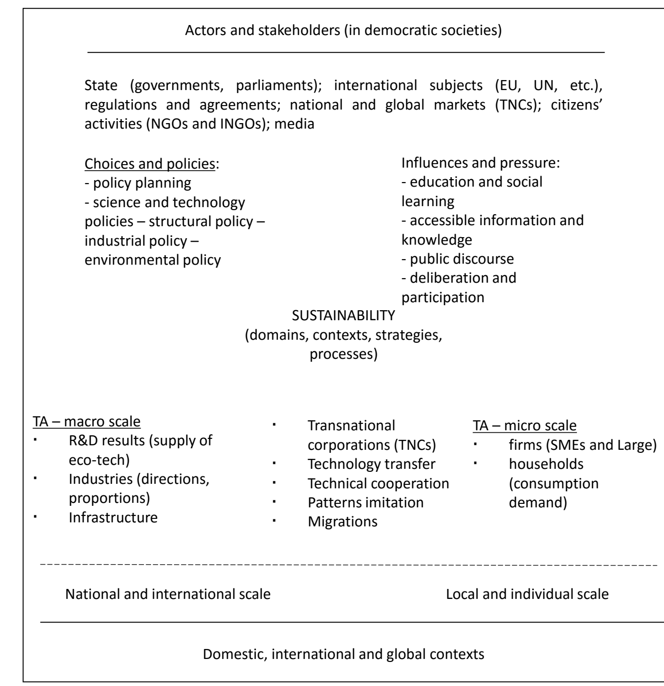


Figure 21: Sustainability and TA areas. A conceptual framework

Some Conclusions

TA can be interpreted in various ways, not only as a social evaluation of technology, but also as a multicriterion assessment. In a broad sense, TA – when considered as technology governance – can be linked to the impact assessment approach, especially in the context of sustainability (as a type of general and global development, a profile of virtually anything whether technology, production, consumption, energy, life, or the future).

The recognition and analysis of the contexts for technology evaluation, impact assessment, technology governance, sustainability strategies, policies, and the behavior of businesses and consumers discover their great diversity (and complexity). Technological stimulation of development needs to be comprehensively evaluated and its impact anticipated. The appropriate structural approaches seem useful for the non-leading countries, which have more difficult choices to make because of unfavorable conditions, self-inflicted mistakes and market failures, global competition, and the unfriendly strategies and actions of others. The simple imitation of high tech economies and societies, the encouragement of which has not been rare, does not seem to be the ideal path to development. Any recommendations should be not academic or abstract, based only on theory and the experience of technological world leaders. The nexus of society, technology, and the market is not the same for all countries (Zacher, 2012a).

References: Page 439

Technology Assessment in East Asia

Experience and New Approaches

António Moniz, Go Yoshizawa and Michiel Van Oudheusden

Abstract

Technology assessment (TA) and TA-like activities in countries like Japan have a unique history and continue to play a role in contemporary science, technology, and innovation (STI) processes. The aim of the discussion of TA's experience in East Asia is how STI governance is locally enacted in Asian knowledge-driven economies, as TA activities develop in conjunction with STI policies and programs. To render these processes, policies, and programs visible and to understand their implications for STI governance, a panel at the Berlin conference on TA discussed contributions that described and conceptualized, for example, how TA activities have emerged in Asian knowledge-based economies (KBE), in which particular forms (e.g., academic and parliamentary TA programs), to which technologies and/or actors they are linked, and which methods are used and why. The panel also sought to compare and contrast how TA is (or is not) institutionalized in Asian countries and regions, and to point to prospects for expansion of TA capacity. In doing so, the panellists placed the development of TA in a historical, sociological, and comparative perspective, and opened space for critical reflection on the potential, problems, and limitations associated with initiating TA in Asia and with KBEs overall.

Introduction and Context

Integrating social and ethical concerns in innovation practice is a well-documented and debated issue in the United States and in Europe, specifically through the EU-wide PACITA project. Related developments in other parts of the world are less discernible – at least to Westerns. Yet, as witnessed by the emergence of technology assessment (TA) in countries like Japan, TA and TA-like activities (for a definition of these terms, see below) have a unique and long history and continue to play a role in contemporary science, technology and innovation (STI) processes, for instance in the areas of citizen engagement with nanotechnologies and energy policy. As Grunwald points out, “there have been contacts between TA researchers and practitioners from Europe and Japan for decades. This exchange of ideas already has contributed considerably to the emergence of an international TA community we are witnessing now” (Grunwald, 2015: 15).

Taking these observations as an entry point, the authors proposed a specific panel session on the topic of TA experiences in East Asia. Following the discussions and research in the PACITA project about the European experiences in institutionalizing TA, it seemed necessary to establish new links and bridges between experiences in research and to search for similarities and divergences. This could facilitate a better understanding of the motivations (personal and institutional) and the strategies of policy advice on science and technology, as well as of the consideration of ethics and processes of responsible research for innovation (Delvenne et al., 2015). There are few opportunities to meet representatives from such a diversity of countries and cultural backgrounds in the field of TA. The 2nd European Conference organised by the PACITA project in Berlin presented an excellent opportunity to promote debate on the aforementioned issues. The panel, which was organized by researchers from different backgrounds and of different nationalities, drew a large and varied audience. The panel participants were Masaru Yarime (STIG, Graduate School of Public Policy, University of Tokyo), Tateo Arimoto (GRIPS, RISTEX-JST, Japan), Young Hee Lee (The Catholic University of Korea), Takahiro Enoki (The National Diet Library, Japan), and Shingo Kano (Department of Medical Genome Sciences, University of Tokyo, Japan).

The panel was asked how STI governance is locally enacted in East-Asian knowledge-driven economies. Like their Western counterparts, nations like China, Indonesia, Japan, the Republic of Korea, Singapore, Taiwan, and Hong-Kong have undergone and continue to undergo rapid science- and technology-driven industrialization. In these processes, TA and TA-like activities develop with STI policies and programs and typically do so in nation- and region-specific ways.

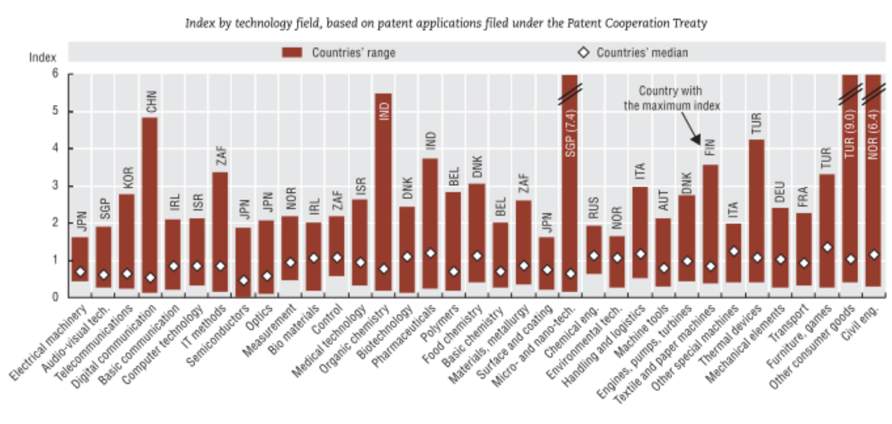


Figure 22: Countries' range of revealed technological advantages by field, 2008-2010
Source: OECD, Patent Database, June 2013, and OECD, 2015: 223.

From the OECD data presented in the figure above it is clear that some East-Asian countries still play a central role in the development of some key technologies, such as "electrical machinery", "semiconductors", "optics", "surface and coating" (Japan), "audio-visual technologies", "micro- and nano-technologies" (Singapore) and "telecommunications" (South Korea). The same applies to the ICT sector as shown in the next figure.

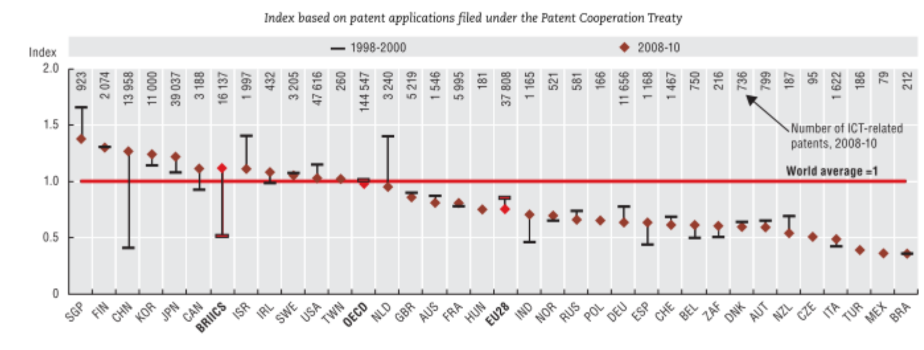


Figure 23: Change in revealed technological advantage in ICT, 1998-2000 and 2008-2010
Source: OECD, Patent Database, June 2013, and OECD, 2015: 223.

This figure highlights the leading position of East-Asian countries like Singapore, China, South Korea, Japan and Taiwan, which all have an index rate on patent applications above the world average. In fact, India, the Philippines and Indonesia showed the highest increases in information and communication technology (ICT) expenditure (Escaith and Inomata, 2011: 30) as can be seen in the following figure.

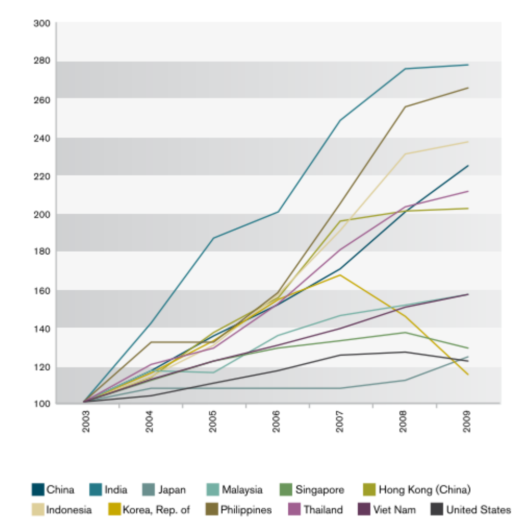


Figure 24: ICT expenditure (current US$) of selected Asian economies and the United States (Index, 2003=100). Source: World Bank, World Development Indicators Database.

Note: as the index is based on current dollars, the seemingly poor performance of the Republic of Korea in 2008 and 2009 is mainly due to the depreciation of the Won.

As mentioned in the WTO and IDE-JETRO report on East-Asian economies, "for World Bank economist Nihal Pitigala, East Asia's emerging economies have benefited considerably from the development of vertical production networks. These networks have enabled them to join at the production stage that best corresponds to their level of technology, with the result that they have enjoyed rapid trade and output growth" (Escaith and Inomata, 2011: 74).

To render these processes, policies, and programs visible, and to understand their implications for STI governance, this panel discussed contributions that:

- Described and conceptualized how TA and TA-like activities have emerged in Asian knowledge-based economies (KBE), and in what particular forms (in some cases with academic and parliamentary TA programs, in other cases linked to certain technologies and/or actors); and discussed which methods are used in those TA activities and why.
- Reflected how these activities have evolved with, sustained, and/or countered STI policies on the regional, national, and international level.
- Compared and contrasted how TA is, or is not, institutionalized in Asian countries and regions, e.g. through initiatives to initiate or abolish various TA forms, such as health TA, early-warning TA, and parliamentary TA; and/or point to prospects for TA capacity building.
- Situated the above processes within a broader theory of, and movement towards, new STI governance frameworks, such as anticipatory governance, responsible research and innovation, and public engagement.

By placing the development in historical, sociological, and comparative perspective, the panel sought to open a space for critical reflection on the potential, problems, and limitations of initiating TA in Asia and draw connections to STI governance processes in other KBEs across the globe. It followed Morita's assertion (2015: 17) that "it is impossible to pursue technology assessment without a precise grasp of the social situation."

Managerial TA

Our scope was so broad as to include "TA-like activities", by which we mean processes and structures that support problem definition and decision making for technology and society development in anticipation of societal implications but which are not explicitly labelled as TA (Shiroyama et al. 2009). Examples include science communication and environmental impact assessment, among others. Like Australia (Russell et al. 2011), we find a number of TA-like activities in the form of ad hoc processes in East Asian countries. However, except for South Korea, there has not been any institutionalisation of TA or organisations dedicated to TA. Young Hee Lee (The Catholic University of Korea) reported about the experiences of this East-Asian country at the panel session of the Berlin TA conference organized by the PACITA project.

In Japan, TA has come into the spotlight several times since the 1970s, but serious misinterpretations have impeded its effective societal embedding over the last forty years. First, technology and policy experts directed their attention to technology and to a limited range of technology's impact, as if TA were synonymous with an "evaluation of technology" or "technical assessment." Second, TA is not the kind of activity that technology developers undertake on their own. Early adopters of the concept of TA in the United States, such as R.A. Bauer and R.W. Lamson, narrowly focused on the managerial aspects of TA and suggested that TA should be a self-organized monitoring process in the management of technology (Yoshizawa 2012; Yoshizawa 2015). This managerial type of TA was welcomed by Japanese systems industry managers and technology experts in the early 1970s (Yarime, 2015).

Japanese TA-like activities are based on the concept of a total system, which is to be represented as a single explicit, self-contained entity encompassing a variety of actors' values. This system view does not take account of issues that are deliberately left out of consideration. Moreover, it suggests that TA practitioners are objective observers who can find an optimal solution by integrating these perceptions. This view can be rooted in the Japanese trend in the late 1960s, which Sato (1985) appropriately illustrates as follows:

"A notion that can be named 'system myth' had been developed among managers, politicians, social scientific researchers and planning administrators as they learnt research and development in the United States, symbolized by the success of the Apollo project, and attempted to introduce it into Japanese society. This is a belief that any issue can be dissolved into its constitutive subordinate issues and technically or scientifically' resolved by prioritizing and integrating solutions."

A possible actor to undertake such a task is the think-tank type of organisation, which specializes in TA. Experts in East-Asian countries are doubtless keen to introduce and develop methods for TA utilising quantifiable data. However, they have been less interested in the institutional and functional aspects in policy and society. Thus far, the Japanese supporters of TA appear satisfied with importing methods for technological forecasting and establishing think tanks for systems analysis, without taking into account the uncertainty and ignorance concerning future techno-societies. New inputs into this discussion on how to broaden and deepen TA can be followed in the different chapters in the book edited by Moniz and Okuwada (Moniz and Okuwada, 2015).

From ELSI to 'Broadening Out' and 'Opening Up' TA

Taking lessons from the ethical, legal and social implications (ELSI) of genomic research in East Asia, we should facilitate wider collaboration and public participation in TA and empower stakeholders and citizens to become involved as long-term interactive partners in technology development. Further understanding of the interactive dynamics between the global agenda and shared local concerns will be needed to facilitate the wider involvement of East-Asian countries in global TA. In addition, there is a need to promote public trust in TA through the consistent application of regulatory requirements, public engagement and cross-border collaboration (Yoshizawa et al. 2014). In some East-Asian countries, including Japan (Wakamatsu 1999), Korea (Kim 2002) and Taiwan (Chen and Deng 2007), participatory technology assessment (pTA) flourished in the 1990s. Yet, it seems that the experience with pTA was not sufficient for the experts in these countries to earn the public's trust. In Japan, research community governance has undergone little change over the past century, and this can be the real problem behind the unsuccessful history of TA institutionalization. Japanese academic societies originally emerged and evolved with the establishment of national universities to nurture technocrats and alumni reunions in the nineteenth century. Although mostly funded and supported by public money, researchers have been free from accountability and responsibility to society. As a consequence, retaining power and influence over legislative and administrative bodies makes them more likely to devalue TA organizations (Yoshizawa 2015). Masaru Yarime (STIG, Graduate School of Public Policy, University of Tokyo) referred to these situations in his presentation on the emerging experience and practices of stakeholder collaboration platforms concerning innovation for sustainability. Similarly, Shingo Kano (Lab. Innovation Policy Research, University of Tokyo) referred to the relationship between technology forecasting and the jurisdiction of technology in the case of Japanese medical devices. Tateo Arimoto (GRIPS, RISTEX-JST) reflected on the bridges between science and policy, based on the lessons learned from the 2011 Great East Japan Earthquake. Finally, the presentation by Shinichi Kobayashi and Takahiro Enoki (both from the National Diet Library) addressed the relationship between the political system and its need for further technology assessment and scientific advice for further policy- and decision-making to be carried out.

There are more public state-oriented organizations in the East-Asian countries than other private bodies embodying social responsibility, such as philanthropies and non-profit organizations in Western countries. Although civil society organizations (CSOs) have more power and authority in some areas in East Asia, like Hong Kong and South Korea, their financial basis is relatively weak. Private corporations thus have less opportunity to be aware of the societal implications of their for-profit activities that would be monitored by CSOs. The bottom line is that there are still very few agencies in the East-Asian countries, whether private or public, which appreciate the role of TA in society and the market. In the dynamic field of knowledge exchange, individuals are no longer associated with a single organisation. They are essential actors for maintaining inter-organisational networks and collaboration by means of organisational improvisation and communities of practice. For this, individual cognition, connections and commitments are fundamental in the dynamic and sustainable management of a malleable and vulnerable intermediary that is responsive to situations, contexts and environments (Yoshizawa 2012). In this sense, TA-like activities encourage the establishment of institutions dedicated to TA by embedding the necessary functions into society. This is one of the approaches to 'broadening out' and 'opening up' TA (Ely, van Zwanenberg & Stirling 2014), which can also be framed in the multi-level perspective of technological transitions (Genus & Coles 2008). As Lee formulated the

problem in the panel discussion, however, such distributed governance always asks the members a simple but tricky question: 'TA for what and whom?' Issues concerning the identification of (potential) clients for TA and the effective delivery of output to them, on the one hand, and issues of the legitimacy and credibility of TA practitioners, on the other, are two sides of the same coin.

Conclusion

Unlike European parliamentary TA organizations that have various intervention mechanisms at their disposal to ensure interactions among the spheres of parliament, government, science and technology, and society (van Est, Ganzevles & Nentwich 2015), East-Asian TA and TA-like practices appear to have weaker ties with parliament, as well as with science and technology, where the government (and wider society at times) are largely involved in the practices (see also Shiroyama et al., 2009; Taniguchi, 2015). This implies relatively poor solidarity and social intelligence in scientific communities and universities as well as in parliament, which may hinder efforts to empower the two spheres, to create balance to the government and to incubate intermediaries, networks and social space for TA. One of the findings of the PACITA project, as Scherz and Merz point out, "was that TA almost always had a chance in countries where strong R&D infrastructures formed the basis of quite well developed economies and public welfare" (Scherz and Merz, 2015: 69). That can be the case in Japan, South Korea and other East-Asian countries. Moniz and Boavida (2015: 76) reinforce this perspective, stating that the issue of TA institutionalization "can be of interest to those in the TA-related community and policy makers in Japan (and other East-Asian regions) who do not have a formalized PTA system. The discussions and attempts being made in some European countries can give some indication of the challenges and possibilities for the institutional formalization of TA". As Büscher points out in the same book, "trust cannot be enforced or successfully subjected to advertising. The build-up of trust takes a long time. Yet the corrosion of trust takes only minor occurrences" (2015: 127). In this sense, and given the country's increased presence in the international knowledge economy and technology governance, it is important to include China in any further study of East-Asian TA.

References: 440

Characteristics of TA Institutions by Agencies and South Korea's Experience

A Study in Terms of Participants and Methodology

Yeonwha Kim and Seung Ryong Lee

Abstract

The purpose of this article is to compare the characteristics of technology assessment (TA) on the basis of differences in governance and to introduce the South Korean TA institution. Most of the countries which have TA institutions are in North America and Europe. South Korea is the only country with a TA institution in Asia, and its government sponsors TA and uses its results. We categorize TA governance into four groups: US OTA, legislative assembly-affiliated institutions, independent organizations and the government. The aims, methodology, emphasis on assessment, and the pros and cons of each form of TA governance will also be analyzed. Then we will introduce a new type of TA institution as the administrative instrument for governing technology, as is the case in South Korea.

Introduction

Technology assessment (TA) was first introduced in 1970 and has been institutionalized in various countries in accordance with the socioeconomic responsibilities of S&T. But the methodologies and institutions vary depending on the given purpose of TA and the culture of a society. The USA institutionalized TA as a legislative assembly-affiliated organization, which offers expert opinions to the members of Congress to provide them orientation on S&T matters. Europe also started TA in institutions closely related to parliament, but there are now differences between European countries. While parliament governs TA directly in France and an organization affiliated with parliament performs TA in UK, some European countries such as Denmark and Netherlands ask independent organizations to conduct TA and put high priority on public participation. Alternatively, instead of Congress or parliament, the government can also implement TA. In South Korea and Austria, for example, TA has been institutionalized and implemented by the government.

Several Criteria for Classifying TA

TAs can be classified from several different chronological viewpoints. Berloznik and Van Langenhove (1998) classified TAs into three generations according to historical features – early warning, constructive, and integrated TA. Early warning TA focused on the social impact of technology (1960s), constructive TA laid stress on the participation of stakeholders (1980s), and integrated TA was scientist-centered (1990s). Van Den Ende (1998) divided TAs into four classes based on the time flow of the technology development – awareness TA which emphasizes forecasting, strategic TA which highlights offering information, constructive TA which emphasizes the participation of citizens, and back-casing TA which predicts the effects of technology on society in the form of scenarios.

Meanwhile, TAs can be also categorized by their characteristics, such as methodology, the performers, and their perspectives. Vig and Pascen (2002) divided TAs into an instrumental model and a discursive model. In the instrumental model, TA is conducted with an expert orientation to offer an S&T agenda to legislators by assembly-affiliated organizations such as OTA (a previous form of GAO), POST, and STOA. On the other hand, the discursive model emphasizes public participation. TA institutions such as DBT and Rathenau follow this model. They put a high priority on public participation, which aims at promoting rich and active discussions and supporting policy making. TAs can be also classified by the TA performer. Academic TA is centered on TA researchers, industrial TA is implemented in the industrial sector, parliamentary TA supports decision making by parliament, executive power TA supports decision making by the government, and laboratory TA is performed by researchers. Parliamentary TA has, finally, been classified into political TA, technocratic TA, and societal parliamentary TA (Cruz-Castro and Sanz-Menéndez, 2005).

Classification of Institutionalized TA by Agents

The institutionalization of TA is very important for policy making because institutionalized TA can be performed in the national context and has a great opportunity to have a big impact on building S&T strategies. This institutionalization requires a specific agency to organize, manage, and perform TA. Here, we will focus the agencies for TA and classify TAs by the characteristics of their agents into four groups: legislative assembly-affiliated TA (GAO in USA), parliament-led TA (many European countries), independent TA (Rathenau in Netherland), and government-led TA. South Korea employs the last one, government-led TA. The Korea Institute of Science and Technology Evaluation and Planning (KISTEP) is the agency of the Ministry of S&T and ICT and Future Planning (MSIP) which manages the national science, technology, and research strategies. KISTEP performs TA separately but not independently of the government because MSIP sponsors and supervises it.

The main purpose, method, and participants of TAs vary according to the leading agents. For example, Congress-led TA by GAO aims to support legislative activity by providing detailed analyses. Hence, it is close to instrumental TA and highly expert-centered. Also, a Congress-led agent delivers the expert-based information to Congress. In contrast, the agents independent from government focus on public debate and emphasize democratic communication on S&T, which tries to involve more citizens in the TA process.

Despites the inherent differences between the different types of TA institutions, they share the common objective that TA results should initiate political action in the field of S&T policy or initiatives on technology-related issues. Currently a main challenge for TA activities is for it to make the proper political actions, and most of the actors in TA should take the political impact of TA into consideration. Thus, TA institutions inevitably have a close relationship with parliament.

Leading	Congress-led (US)	Parliament-led (Europe)	Independent	Government-led
Form	Congress-affiliated * relatively large scale	Legislature-affiliated, Parliamentary Office	Independent agent, Independent board * closely associated with parliament	Government-affiliated
Agency	OTA (US, 1974~1995), GAO (US, 2002~) * the first launching	POST (UK), TAB (Germany), OPECST (France)	Rathenau (Nederland), DBT (Denmark)	KISTEP (South Korea)
Main Purpose	To support legislative activity of congressmen with detailed analyses	To offer Information to members of parliament	To encourage public debate and democratic communication	To reflect on related policies (not forced)
Method	Instrumental model	Instrumental model	Discursive model	Two-way mixed model
Participant	expert-centered	expert-centered	citizen-centered	expert and citizen

Table 21: Classification of TA by agents

Institutionalization of TA in South Korea

TA in South Korea was institutionalized in 2001 by the Framework Act on Science and Technology. The first assessment was conducted in 2003, meaning that more than 10 years of experience performing TA has been gathered in South Korea. The aim of the TA framework in South Korea is to find the right direction for technological development. This Framework suggests that TA be performed in five separate aspects (economy, society, culture, ethics and environment) and policies be formulated for relevant S&T on the basis of the TA results. The framework also suggests that TA results should convey the following values: (1) the way to maximize the benefits for people's lives from technology and making it contribute to the development of related industries, (2) the impact of technology on the economy, society, culture, ethics, and environment in South Korea, (3) and the plan to prevent the negative side effects that technology might bring. In this regard, TA in South Korea is required to suggest the specific policy for the selected technology.

As mentioned previously, TA in South Korea is performed by KISTEP with the government organization, MSIP, while other European countries choose independent or legislature-affiliated agencies to be TA performers. This government-oriented TA in South Korea can be attributed to the country's political history. In 1960s and 1970s, the South Korean government put the highest priority on national economic growth and showed very strong and top-down leadership on the technological development. Even after the end of the military government in 1986, technology development has been guided by the government. The South Korean governments started considering democratic ways to policy making, and the government greatly encouraged social bodies to participate on preparing policies once the TA framework had been initiated (Kim, 2012). This background has helped determine the unique Korean TA model, which presents a convergence of the instrumental and discursive models, to offer advantages from each of them.

However, citizen participation is still limited, and experts are main players in TA. South Korean economic history may account for this. Since the 1960s, South Korea has experienced strong economic development, in part because of a series of national strategies on the economy and S&T. Especially in the fields of S&T, experts played important roles in achieving innovative technological developments which have led to economic growth, which consequently made positive impressions of both S&T and experts on the general public and on government leaders. So far, the targeted technology has been expected to provide national economic growth and a better future.

The main roles of KISTEP as an agency of MSIP are to build national strategies on S&T, set the national R&D budget, evaluate the R&D results, and providing technology foresight. Such TA is organized and implemented in South Korea by the foresight department. Thus, TA should be in a line with technology foresight and evaluation for building national S&T strategies. In this sense the targets of TA are the emerging and near-future technologies rather than the controversial or issue-pending ones. It shows that the aim of TA in South Korea is to engage in an earlier stage of technological development on the basis of scientific evidence and public concerns.

Since 2003, KISTEP has conducted TA for more than 10 technologies: Nano·Bio·IT (2003); RFID (2005); stem cell, nanomaterial, and ubiquitous computing (2006); technologies for climate change (2007); technologies against pandemics (2008); big data (2012); 3D printing and smart network technology (2013); unmanned mobile vehicles, and Hyper-tall construction (2014). The Act as modified in 2011 states clearly that TA should be conducted at least once a year.

TA by the Government Agent in South Korea

The MSIP sponsors and manages TA, but TA is performed by KISTEP. KISTEP organizes two committees, a citizen forum and an online bulletin. The first committee selects the target technology for TA; this committee consists of disinterested individuals from various organizations including academics, companies, government, research institutes, and the public. Then, the second committee analyzes the targeted technology, and it consists of relevant experts from various disciplines ranging from science and engineering to ethics and an entrepreneur. Volunteer citizens form the citizen forum. They are further educated about the technology and then participate in the active discussion about the related issues. In addition, making the online bulletin brings more people into TA and serves to collect public opinions.

After TA, the results and recommendations from TA are reported to the National Science and Technology Council (NSTC). The heads of the central administrative agencies concerned, such as the ministries of Environment, Industry, Health and so on, are also notified.

The minister who receives the TA reports should forward them to research planning for the national R&D projects. The countermeasures to minimize the negative side effects of such technology should be also determined and executed on the basis of these TA reports.

The strengths of TA in Korea are the result of multiple aspects: (1) the institutionalization by law, (2) the composition of an expert-oriented committee which ensures objectivity and fairness, (3) the opinions from citizens which trigger the active discussions between experts and the citizen forum, and (4) the clear statement about the application of TA results to the related policy. However, there are still several weaknesses and, thus, more improvements are required. For example, the ministry plays a double role in TA, which enables government to inadvertently influence the decision making of TA. Although MSIP does not manipulate or intervene deeply into TA, it has opportunities to express its opinions strongly when selecting target technologies and making a recommendation. Based on the TA reports, MSIP produces a final TA document to submit to the NSTC, which considers the effects on related policies. That is why MSIP keeps its eye on the TA process and requires very detailed recommendations that can be quoted without further process. Usually the government also tries to avoid conflicts with other stakeholders. This is also one reason that the targeted technologies are a bit in the future. Limited resources, a lack of interest by the public and other government departments, the difficulty of forcing policy makers to reflect on a TA recommendation, and the difficulty in checking an impact in terms of amount and diversity are also challenges to TA in South Korea.

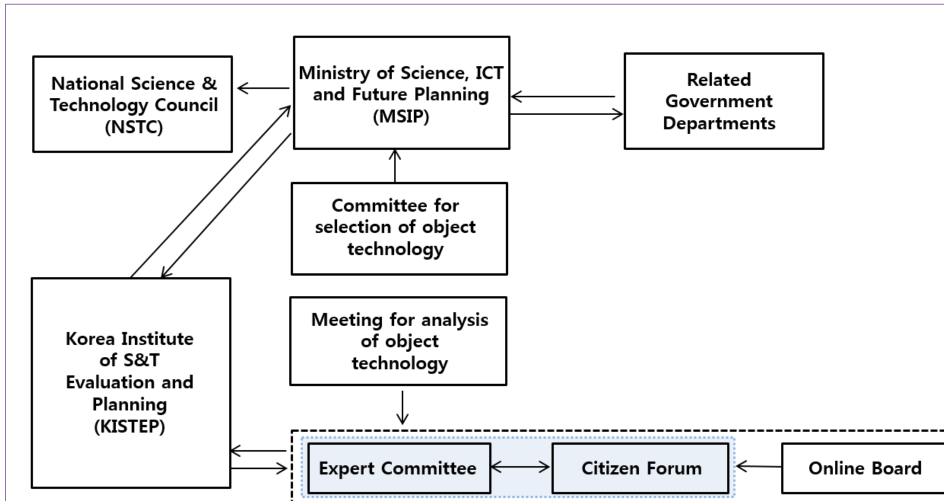


Figure 25: Structure of TA processes in South Korea

Conclusion

A potential conflict exists as the influence of S&T on society, humans, and nature becomes significant, but the technologies do not belong to the general public and are largely run by experts or the government. However, people still expect to find the better way to live with S&T. The wish is not to defeat or control technology but to make S&T meaningful to more people and to make it serve humans and nature. Various countries, especially the US and Europe, have institutionalized the process of finding ways for balancing S&T and society. Institutionalized TA is one important instrument for this purpose. Although TA institutions in various countries share these views for S&T and TA, their institutional details are quite different from each other.

South Korea started TA late, but has made a strong commitment to TA. There are several interesting aspects to South Korean TA. It is managed by the government, but includes participation by citizens as well as expert-centered analysis. The government tries to inscribe TA with the strong vision of emerging technology, and encourages the participation of citizens in a democratic way. The Framework Act on S&T supports TA by demanding that the result and recommendations from the TA process must be considered by policy makers on related technology. But the act is at the same time a burden to the performers of TA because the government requires very detailed and ready-to-use information on related policy, for example, for which a certificate for a new technology is needed or which details how experts should be trained. These limitations further call for the improvement of TA in South Korea. Recently, the Assembly of South Korea has tried to perform TA separately from the government.

References: Page 441

Why Do Farmers Have a Low Propensity to Adopt Soil Conservation Technologies on the Degraded Steppe Land in South Russia?

Ladislav Jelínek and Miroslava Bavorová

Abstract

This paper analyzes the socioeconomic factors that diminish farmers´ motivation to adopt conservation soil management in the Kulunda steppe in South Siberia. Adoption of conservation soil technologies is a complex decision-making process. Three groups of barriers were considered during qualitative interviews and confirmed as being highly relevant: (i) the high investment costs of conservation technology, (ii) the high learning costs for farmers, farm managers and farm workers, (iii) the persistent institutional impediments on the land market and unresolved property rights on land. The preliminary results of this on-going study suggest that the identified barriers could be overcome by implementation of incentive-based measures supporting conservation soil technologies which are currently missing. Furthermore, information campaigns have the potential to support the adoption of efficient soil conservation technologies.[1]

Introduction

In the 1950s and 1960s the government decided to cultivate the natural grasslands of the Kulunda steppe, which forms a large part of the Altai region situated in south Russia. Around 7 million ha of the Kulunda steppe were used for agricultural production. The cultivation practices introduced there, which were aimed particularly at achieving high production, were not always well adapted to the marginal ecosystem of the steppe. That caused severe negative effects namely, soil degradation, decline in soil fertility, and drop in yield within a few years of the start of cultivation.

The urgently needed soil conservation methods had already been developed (i.e. reduced tillage) and partially adopted in the 1980s. However, the new socioeconomic conditions after 1990 created new challenges for farmers and also raised the risks of land overexploitation.

Land degradation continued further. The official statistics states that 75% of agricultural land is currently environmentally degraded to some extent (Federal Cadastral Service, 2012) and that around 44% of land has been abandoned (Minselchoz, 2014). Among the most severe processes is desertification (Gruza 1999, Frühauf And Meinel 2007, Meyer Et. Al. 2008), with wind erosion constituting the most serious problem in the region.

To reverse soil degradation processes and their negative environmental consequences, cultivation technologies need to be adopted that take the exigencies of the marginal ecosystem "steppe" into account. Among the important sustainable practices to combat soil degradation is reduced tillage (e.g. Damman 2011; López Et Al. 1998; Meinel 2002).

Adoption of such soil conservation technology is inevitably preceded by a complex decision-making process. Previous studies point to the factors that influence the adoption behavior of environmental farming practices: the characteristics of a farm and farmers (Crabtree, Chalmers, And Barron 1998; Wynn, Crabtree, And Potts 2001); attitudes and perceptions towards conservation practices (Black And Reeve 1993; Defrancesco Et Al.2008; Vanslembrouck, Van Huylenbroeck, And Verbeke 2002); financial factors (Morris And Potter 1995; Wilson And Hart 2000; Ducos, Dupraz And Bonnieux 2009; Sutherland Et Al. 2012); the institutional design and the requirements of policy measures (Polman And Slangen 2008; Dupraz, Latouche, And Turpin 2009; Fraser 2011); and information factors (Lowe And Cox 1990; Morris And Potter 1995; Warriner And Moul 1992; Skerratt 1998).

In this paper, we are concerned with the socioeconomic and institutional determinants that guide farmers in the Kulunda steppe in their land use decisions. We conducted an explorative qualitative investigation in the region and studied the forces that keep farmers from adopting sustainable cultivation practices in specific semiarid steppe zones of southwest Siberia.

In the next section we review the barriers in the soil cultivation technologies considered, after which we introduce the applied empirical method. Then, we discuss our results and outline the policy implications.

Framework: Barriers to Adopt Soil Cultivation Technology

From the point of view of neoclassical economic theory, farmers' motivation to adopt an innovation is driven solely by profit maximization. The institutional theories, however, relax the assumption concerning profit maximization and extend the microeconomic decision-making model by concepts such as transaction costs, property rights or bounded rationality. The further extension of economic behavior in innovation adoption models involves the prosocial behavior such as decision-makers' consideration of the ecological impact of the system adopted. Following the literature review, we selected significant barriers as perceived by the farmers to the adoption of soil cultivation technology (see Figure 26 below).

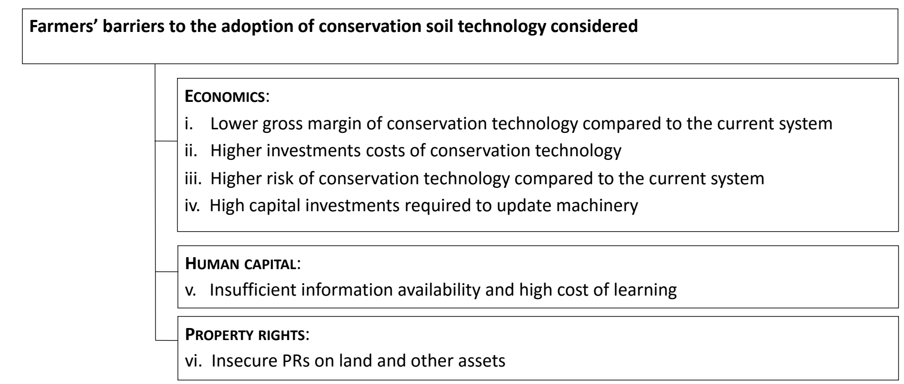


Figure 26: Selected significant barriers to adopt soil conservation technologies in Altai Krai
Source: Authors

Based on the theoretical assumptions and recent empirical findings, we want to test the following hypotheses:

Farmers are not adopting conservation systems because they perceive:

1. the gross margin is lower than in the current system,
2. the risk (in yield fluctuation) is too high compared to the current system,
3. the investment costs are unduly burdening, giving the economic situation of farms,
4. the available information is limited,
5. the costs of learning are too high,
6. the property rights on land are not efficiently executed and investing to improve soil quality is distracting.

Methods

We have carried out two rounds of the qualitative surveys, in which totally 15 semi structured, problem-centered interviews were conducted in 2014. The interviews were carried out at various institutional levels: micro (individual farmers and enterprises, ecological associations and professional groups), policy administrators and policy execution. We investigated the subjective assessment as what the actors perceive as the barriers to the adoption of conservation tillage. In addition, we conducted special in-depth interviews with the local farm experts oriented toward perceived gross margin, investment load and riskiness of the no-till system.

The definition of the tilling technologies

For the purpose of this study, we defined two types of the alternative tillage technologies that are currently applied in the region:

1. Conventional intensive tilling system with varied depth of soil cultivation.
2. Conservation tilling systems:
    a. minimum tillage with less intensive, less deep soil cultivation without plowing,
    b. no-till soil cultivation in which soil is not mechanically cultivated.

Currently, a number of modified crop cultivation systems are utilized in the Kulunda steppe. Conventional intensive tilling system with deep intensive soil cultivation and plowing has been the prevailing technology since steppe cultivation begun. The alternative system with reduced tillage was already introduced in the 1970s together with additional anti-erosion measures like forest strips. The character of the soil and the continuous degradation process, however, required to improve the conservation methods. No-tillage cultivation of the arable land is such an alternative and has recently been introduced in the region. A regional expert estimates that only around 2%–5% of the farmers currently employ the no-till system on arable land.

Results and Discussion

We start off with the analysis of the effect of barriers on the adoption of conservation soil technologies (shift to reduced tillage or no-till). First, we discuss the economic factors including investment requirements and associated risks that result from the conservation technologies implementation. Second, we concern ourselves with the question of how farmers' property rights on land influence their motivation to adopt conservation soil technology. Finally, we analyze the availability of information and the learning costs needed for the adoption decision.

Economics of No-till Technology

We tested hypothesis (1) farmers do not adopt the conservation system as they perceive the gross margin is lower than in the current system, hypothesis (2) farmers do not adopt the conservation system as they perceive, for various reasons, the risk to be too high compared to the current cultivation system and hypothesis (3) the investment costs are unduly burdening, given the economic situation of farms.

Inevitably, the choice of tillage system has an impact on various costs and yields. The costs of labor, fuel and machinery with minimum- and no-tillage are mostly found to be lower than in conventional tillage. According to some studies (e.g., Zentner et al., 2002), however, this effect is counteracted by increased herbicide costs. A similar picture is found for yields. While they are strongly dependent on the site-specific natural conditions (e.g., precipitation and soil quality), we have not found any unambiguous superiority of one or the other tillage system in the literature.

First, we looked at the subjective, ex-ante assessment of farms' economic results, which provided a first glance at the paramount issue. We asked the farm experts for their expectation of the yield change if they were to adopt a no-till system and the effects of this change on their unit costs for herbicides, fuel and labor (Table 22).

Item	Farm Expert 1 (forest steppe, mini till)	Farm Expert 2 (forest steppe, intensive)	Farm Expert 3 (dry steppe, no till)
Yields of grains – "average" precipitation	30%↓	0	0
Yields of grains – very low precipitation	20-30%↑	10-15%↑	↑ (0,8 t instead of 0)
Herbicides consumption for wheat	50%↑	250%↑	200%↑
Fuel consumption	20%↓	60%↓	260%↓
Labor costs	20-30%↓	0	20%↓

Table 22: Economic outcomes resulting from the adoption of no-till technology compared to the current tillage system (farm experts' evaluation, Altai Krai, 2014). Source: Authors.

Farmer 1, who uses currently minimal tilling in the forest steppe, expects a yield decrease of about 30% after introducing no-till given average precipitation and an increase of yield of 20%–30% comparing to the current one in case precipitation is very low. Farmer 2, who currently uses intensive tilling without plowing in the forest steppe, expects an unchanged yield when using no-till in a year given average precipitation and a 10%–15% increase in yield if the climatic conditions are very dry. Farmer 3, who uses no-till for grains and other crops and minimal tillage for sun flower and corn in dry steppe, expects the same yield of wheat if he were to use no tillage given an average precipitation and a significantly higher yield in very dry years. He estimates that in a very dry year the wheat yield would be zero when using tillage and about 8 dtons per ha using no-till.

The farmers' assessments of the use of herbicides in the different tilling systems vary tremendously. Farmer 1 expects a 50% increase in the herbicides used for wheat when comparing no-till to his current system of mini-till. Farmer 2, who uses intensive soil cultivation, expects a 250% increase in herbicides used if he were to use no-till. Farmer 3, who uses the no-till system for spring wheat cultivation (however with one additional cultivation step before seeding in spring), estimates that using minimum till would reduce the herbicides used by 200% than in the currently used no-till system.

Farmer 1 expects a 20% decrease in diesel consumption in no-till compared to his minimum tillage technology. Farmer 2 expects diesel consumption to be about 60% lower in no-till compared to the current intensive system. Farmer 3 expects consumption to be 8 l/ha in no-till and 29 l/ha in minimum tillage, which means consumption about 260% higher in minimum tillage.

Farmer 1 expects a 20%–30% decrease in labor costs from using a no-till system compared to his current mini-till one. Farmer 2 does not expect any difference in labor costs. Farmer 3 estimates labor use in no-till to be 20% lower than in minimum till.

The preliminary conclusion suggests that farmers expect yields to decline for no-till under the usual weather conditions in the forest steppe. They expect a significant increase in herbicide costs and lower diesel consumption. The expected decrease in labor costs in no-till is rather modest. We cannot accept or reject the first hypothesis based on the qualitative evaluation. The conclusion can be drawn once the quantitative assessment (including an optimization model) has been finished. Regarding hypothesis 2, all three farmers agreed that the yield when using no-till fluctuates less in dry weather, and thus we reject hypothesis 2 that assumed that the risk resulting from the yield variability was too high. To support the plausibility of the economic factors of conservation technology we continue to employ our study.

The respondents interviewed in the region declared that the high investment costs and farm budget constraints limited their capacity to invest in conservation technologies and new equipment. They referred to the budget constraints as a reason why they did not decide to invest in the new technologies like seeding machines or straw choppers[2] despite the expected favorable agro-technological outcomes of the change. Those aspects were emphasized across all groups interviewed, although it was emphasized less by the larger enterprises (corporate farms), which seem to be less financially constrained.[3] Besides, there were several regionally specific technological and agro-ecological innovations that needed to be implemented. These operational requirements include, for example, how to spread the straw evenly to facilitate its incorporation in the soil, and how to accelerate the microbiological processes in the soil that would ensure the straw could decompose well in relatively short vegetation period. Therefore, we accept the hypothesis 3 stating that the investment costs are unduly burdening.

Investments vary over farm groups and it suggests different access to the external resources for the farms. Indeed, though the regional statistics on technological investments are relatively poor, they show that the propensity to invest proportionally increases with the size of a farm (Rosstat 2013). However, all farms have been constrained by the high interest rates for external credit. In 2014, the interest rates for the bank credits in agriculture varied between 14% and 24% plus additional costs for the credit processing and administration. Though the registered farms could apply for a governmental subsidy to cover interest, the remaining costs were often beyond the financial capacities of the farms. The proportion from subsidized interest out of the total interest paid is not known, as it varies in time and with the type of the investment.

Information Availability and Costs

Furthermore, we test hypotheses 4: Farmers do not adopt a conservation system if they perceive that the available information is limited, and hypotheses 5: Farmers do not adopt a conservation system if the perceived costs of learning are too high.

Regarding the availability of information, we have not identified any critical barriers that would prevent farmers from gaining access to information on conservation management. The traditional notion of land users was “those who want to get to know about conservation technologies can find them”. The input suppliers and the media – specialized agricultural newspapers (e.g. Agromax Journal) and specialized Internet sites – were among the most frequently cited sources of the information. Information provided by the machinery and other input suppliers were highlighted by some actors as “playing the biggest role”. Some farmers stated, however, that they do not trust this information fully as such information may be “biased” as the main aim of the companies is to sell their products. Furthermore, the public Altai Institute for Advanced Training in Agriculture has provided an extension service for farmers on various economic and agronomic themes, including the soil conservation methods. Nevertheless, their impact was evaluated by the farmers as being rather minor. Furthermore, farmers expressed concern during the interviews about the lack of academic information, particularly on no-till technology operating in the steppe zones. They suggested such information should be provided by research institutes and universities. We can, therefore, reject hypothesis 4, which assumes that the information on alternative cultivation is not available.

The interviews also uncovered that the use of private, paid external consultation services seems to increase with the size of the enterprise. One of the reasons can be the fact that the additional costs for the small farmers are too high. Furthermore, participation in social networks such as committees, meetings, neighbors and colloquia were mentioned as sources of reliable information, in particular for managers and heads of farms.

The interviews further showed that those farmers who did not adopt conservation tillage tended not to be aware of the complex knowledge about the long-term impact of reduced tillage management on the costs and yields (although they agree with the statement that the information they need is available). Furthermore, they are not able to assess appropriately the risks (e.g., yield variability) of the new technology and the investments needed to change the technology.

Based on the explorative interviews, we hypothesize that the larger (and more diversified) a farm is, the more likely it is capable of absorbing the required knowledge. This may be explained by the fact that larger units have more specialized experts at their disposal. However, we identified a weak capacity to absorb conservation-related information, especially by the manual workers on large farms. And knowledge about conservation management practices by these workers was very relevant since their willingness to employ this new knowledge does not increase until they understand the reasons and the positive impact of the change. Thus, we partially accept hypothesis 5 which assumes that the cost of getting information on alternative cultivation is too high. This appeared to be particularly relevant for employees of (corporate) farms and for smaller farms.

Property Rights to Land

The theory of property rights asks an important question “What does it mean to own an asset?” (Slangen, 2004). That is, the economic importance of ownership depends on the owner´s ability to exercise, ideally with low transaction costs, residual rights of control over the assets.

Formal land ownership was introduced in the 1990s in the region, which seems to be insufficient time to change peoples´ attitudes to the possession of land. Currently, state and private entities each own around half of the land fund, which results in the high share of rented land, accounting for more than 90%.

At least two aspects of the current property rights structure created barriers in the innovation process. First, the discrepancy between land use and ownership (resulting in a high proportion of rented land) constantly breaks the ties of the users to the land. As a consequence, the intrinsic motivation of the users to protect the soil is weak. As a consequence the commitment to protect the land or natural values general is still lacking in the Krai. Secondly, several administrative and institutional weaknesses undermine the effective execution of the land usage rights and implicitly demotivate users and farmers from investing in land quality. Among these factors are particularly unclear ownership titles, missing borders in the terrain, registration of the user and ownership titles, and weak enforcement of the soil protection law.[4]

Although the relationship between the extent of private land ownership and the propensity to follow conservation soil management is more complex, the interviewees often declared that with an increasing amount of private land they are more willing to employ conservation land practices and are willing to invest in soil fertility. Similarly, the interviewees claimed that once they invested in land purchase they were more likely to change the land management to achieve higher fertility.

Most individuals became land owners during the privatization process at the beginning of the 1990s, and approximately 350,000 individuals (current and former agricultural workers) received “abstract” land shares in Altai Krai. To “activate” these land shares, a functioning land market was needed. In the region under investigation, the creation of land market institutions continues to be still an on-going process. For example, the land shares were a kind of certificate that authorized the holders or owners to possess an anonymous piece of land on one hand, but on the other hand this land could not be sold or bought until 2003. Such land shares had to be administratively formalized, which increased the owners´ or users´ transaction costs related to the execution of ownership rights. The process of formalization consisted of legal, administrative and technical duties by which a holder received the land ownership title to a specific plot.

Legislation guarantees to farmers that each land rent contract on state land can be agreed upon for a period between 5-49 years. These state land rental contracts however do not stimulate farmers to invest in protecting the land, as nobody can guarantee they will receive the land once it is privatized. It is not surprising that around one quarter of the state land is not used (Federal Cadastral Service 2012).

We accept the hypothesis 6 stating “the property rights on land are still not efficiently executed and due to that investing to improve soil quality is distracting”.

Conclusions and Implications

In this paper we have addressed selected barriers that constrain farmers in the climatically specific Kulunda region from adopting conservation soil cultivation technologies on land. Given the regional extent of the degraded agricultural land, any limitations that delay the adoption process increase the vulnerability of farms and implicitly of the rural areas.

Three perceived barriers were found to be particularly relevant: (i) the high investment costs of conservation technology and high costs for external funds; (ii) the less efficient transfer of knowledge to the targeted laborers (smaller farmers and wage laborers); (iii) persistent institutional impediments to a functioning land market including unresolved property rights to land.

Up to now, only limited attention has been paid by the local and federal governments to addressing the knowledge capacity of agricultural laborers or to providing the economic incentives to those adopting land conservation.

Furthermore, it was identified that the land users need also to get a better prospect on the farming business as general (e.g. to have a successor for a farm, trust in the institutes, etc.) in order to strengthen the role of private ownership. To put it another way, farmers with poor economic results and no prospects for the future are unlikely to adopt better practices regardless of the land regime. Therefore, the isolated public focus that would only increase private ownership is not likely to change the farmer’s attitude toward the land. Sound investment economic stimulation for the young farmers could be a vital option as well.

We argue that access to information on the technologies is not restricted to any of the farms, but that the capacity of farmers to absorb and implement the knowledge is a limiting factor, as is the technology itself. Particularly large enterprises based on the wage labor face the problem of the quality of the (manual) laborers. The issue is further intensified as the laborers lack essential information on the real effects of the conservation technology (so that they do not develop any motivation of their own to change their habits and practices). We argue that an effective solution should strengthen the advisory and extension system and for it to focus on manual workers and individual farmers. Diffusion of new technology can be encouraged by investing in or improving the information system that drives the innovation process. This might include investments in extension programs, demonstrations, or community leadership training designed to identify innovators (Jolly et al. 1985). Locally situated non-governmental ecological organizations (i.e. Gebler’s Ecological Society) and the Association of Individual Farmers and Cooperatives have the potential to be more involved in the active dissemination of knowledge in the near future as they are closer to the local actors and know their needs.

References: Page 442

Designing a PhD Programme on TA

An Evaluation of Five Years of Experience

António Moniz

Abstract

A PhD programme on TA was approved in Portugal and has been running over the last five years with several success stories, but also strong limitations. It started in 2009 and it has been an important resource for the capacity building for an institutionalization of TA in Portugal. In this paper we describe the main features related to this education program and analyse where the main strengths (international cooperation, research quality, public debate, publication policy, collaboration with parliament and other stakeholders) as well as the weaknesses (very limited public funding schemes, lack of TA expertise in some emerging technology fields) can be found.

Why a PhD Programme on TA?

Working at a faculty of sciences and technology at a research university in Portugal (Universidade Nova de Lisboa, Faculdade de Ciências e Tecnologia, FCT-UNL), social and ethical issues related to emerging technologies have always been an important subject of debate and teaching contents based on case studies. There has been a need to deepen the knowledge on technology-embedded processes in society and to create awareness of the societal implications of technology development among science and technology students. UNL has a long-standing experience in the fields of technology assessment (TA), of science and technology studies (STS), and of sociology of technology.

At the same time, in the decade after 2000, a demand for a specialized study programme for high-ranking professionals dealing with technology decision making arose. STS studies were available at other Portuguese universities, like the University of Porto, the University of Lisbon, the University of Évora, or the University of Coimbra, but there was nothing on TA. The targeted public for this programme is a specific market related to large-sized companies in different fields of industry where technology development is in quick change (transport, telecommunications, electronics, energy, etc.). The consulting services related to technology innovation and strategic management are important, also the public administration services of governmental advice.

The improvement of national economic or social performance through better scientific and technological opportunities for research is a policy aim. That would require the feasibility of more intelligent decision making related to technology. And it combines a consideration of technological and organisational change and management innovation. Therefore, such new needs bring "labour market needs" or "demand" for technology assessors in several economy sectors (large companies, public administration, and national laboratories). Experience has also shown that the acknowledgement of cross-disciplinary research at technical universities can create a need for such competence. But that was not on offer. Universities (and the high education in general) are confronted with the obligation for further collaborations that enable them to offer better solutions to those "market needs" than they could provide on their own. The push towards different universities to cooperate is driven by these new occupational needs. This is also the case for TA (cf. Moniz and Grunwald 2009). Nevertheless, several new steps have to be taken.

PhD Programme on TA Started at UNL in 2009

The PhD Programme on technology assessment in Portugal was organized and created with regard to that framework. It was planned as a 3rd cycle graduate programme in the context of the European Union "Bologna Treaty" reformulations of higher education. This programme of doctoral studies was prepared together with ITAS-KIT to develop an international offer, and was structured to provide students with high quality training in research. The duration is typically 4 years of full-time study. During this period, the candidate typically performs his/her research in the context of research projects of one of the research centres at FCT-UNL in close cooperation with other research institutions in Europe. The Portuguese CICS.NOVA is one of the research centres that support such research, especially through the recently created Observatory of Technology Assessment (in Portuguese: OAT). The programme was approved by the Ministry of Education (Portugal) and accredited by the national Agency for High Education (A3ES) in 2009. Since 2010 it also provided the starting structure for the establishment of the national TA network GrEAT (Böhle and Moniz 2015). This network was recognized with an observer status at the EPTA board of directors. It has a direct relation with the national parliament and a regional parliament (Azores), which also provides an excellent source for TA research to these political institutions (Böhle and Moniz 2015). Members of the parliament participated in several initiatives of the PhD programme and the GrEAT network is supporting the attempts to create the information process for parliamentary technology assessment. Such a process reveals the connection between the policy-making stakeholders and the academic environment for the preparation of technology assessors and for the scientific development of new competences on TA.

The network GrEAT provides TA publications in Portuguese ("Tópicos") in articulation with the PhD programme. The programme also received a growing interest from companies to support it, like Brisa Inovação and the metal industry technological centre (CATIM). The scholarship grants for this programme have several sources (Foundation of Science

and Technology – FCT in Portugal, and National Research Council – CNPq in Brazil). The financial support from the national Foundation of Science and Technology (FCT) has been, however, very limited, while only granted to mainstream research fields.

Interdisciplinarity

Students are from different scientific backgrounds (engineering, health sciences, sociology, economy, management, political sciences) and the common topics to be learned are covering different scientific disciplines like Foresight Analysis, History of S&T and Economy, and Management of Innovation (all provided by the DCSA), Participative Methods (provided by the Dept. of Environmental Sciences), Evaluation of S&T (provided by the Dept. of Chemistry) and Methods of Decision Support (provided by the Dept. of Mathematics). This also means that the programme has an interdisciplinary aspect, where the topics learned cover different disciplines and the researched focus is mainly interdisciplinary. Some of the interdisciplinary procedures imply the promotion of institutional cooperation within the study cycle, too. This includes the participation of PhD students in the activities of CICS.NOVA and other UNL research centres, and of GrEAT. Examples are the Reading Labs on Technology Assessment, the conferences at CICS.NOVA, or other conferences and seminars organized by GrEAT; to add to those activities there is also the possibility for applied research internships at the Karlsruhe Institute of Technology, KIT (Germany).

The collaboration with the PACITA project on parliaments and civil society in technology assessment widened the scope of the collaboration scheme. Such practices involve a range of methods of cross-disciplinary expert studies, stakeholder involvement, citizen consultation, and parliamentary discourse. The PhD students already attended the PACITA Summer School 2012 at the University of Liège (Belgium), the Practitioners International Workshops (Portugal, Bulgaria and Lithuania), and national workshops and conferences in other countries.

The traditional disciplinarily focused higher education will be replaced by a cross-disciplinary learning process. And the most successful experiences will be those that can offer a higher quality teaching system with collaborative capacities where universities from different regions and countries offer joint diplomas, or can cooperate in the teaching and research processes. The few experiences are paving the way in this direction.

Learning Structure

Technology assessment is related to decision-making processes around science and technology options and innovation structures. It can be linked with policy advisory activities or just larger economic and financial options associated with technological developments. For these reasons, the student should have skills on history of science, methods of decision processes, foresight methods, economics of innovation, technology management, and evaluation methods.

The existence of Thesis Project courses from the first semester of the programme aims to place each doctoral student within his or her line of research as early as possible. Besides that, the PhD students participate in the Winter Schools on Technology Assessment that have taken place annually since 2010 where the PhD students must present their thesis plan. The thesis plans are published in the "IET Working Papers Series" with their impact factor. Later, at the Doctoral Conference, the PhD students present their provisional research results. Students organise their presentation as conference papers and should publish them in a scientific peer-reviewed journal.

Title	Author	Status
Decision-making process in radiology: the magnetic resonance example in the TA context	Maria J. Maia	To be finished in 2016
A Constructive Technology Assessment of Stationary Energy Storage Systems	Manuel Baumann	To be finished in 2016
Technology Assessment of the Quality of Magnetic Resonance Imagery	Jorge Moura	
Decision making processes based on innovation indicators	Nuno Boavida	To be finished in 2015
Corporate technology assessment applied to the manufacture industry of the high-speed train	Susana Moretto	To be finished in 2016
Disruptive innovation: Assessment of cloud computing applications	Ana C. Cândido	Finished in 2015
Electroencephalographic assessment in children with auditive deficits	Isabel Rosa	Finished in 2015
Bridging present and future of Brain-Computer Interfaces: Assessments of Impact	Gabriel Velloso	To be finished in 2016
Intelligent infrastructures for the road transport system	Tomé Canas	To be finished in 2017
Technology Assessment of Personal Air Vehicles as an Emerging Technology Option for Regional and Urban Transportation System	Abdurrahman Yazan	To be finished in 2018
Additive Manufacturing Technology Assessment: Implications at the Metal Sector	Nuno Araújo	To be finished in 2018

Table 23: The current projects of the TA PhD programme

The doctoral programme in the field of technology assessment contributes to an understanding of the interplay between science, technology, and society. This interplay is yet to be fully grasped in Portugal. A perception of the phenomena of continuities and breaks, successes and failures within the knowledge and power domains of the sciences and technologies, and the connections between innovation, decision process in science, and technology are developed to foster a participatory and conscientious citizenship, an ethics of science and technology, and the processes of decision making and choices of technologies. Examples of these issues can also be found in the fact that many of the publications by PhD students of TA are developed in international and disciplinary cooperations (Baumann et al. 2012; Boavida et al. 2012 and 2013; Coenen and Velloso 2014; Fournier et al. 2014; Maia and Krings 2014; Moniz and Krings 2014a and 2014b; Moniz et al. 2014; Moretto, Palma and Moniz 2012; Moretto et al. 2014; Seitz, Maia and Velloso 2013).

Thus this can be considered as an innovative programme within the national and international framework, with strong international links in terms of research. There is also a strong link between professional activity and research and a full international recognition of the work

developed. However, the weaknesses can be the difficulty of recognition by the evaluation systems about the need for interdisciplinary advanced training, the fact that there are few national experts on TA, and the weak tradition of TA studies in Portugal. Another problem that can be raised is the lack of established structures for TA at the level of companies, health organisations, and public services. The absence of parliamentary TA units (at national and regional parliaments) can also be mentioned, although there are some steps taken to solve this problem.

All in all, the effective effort to foster the area of technology assessment in Portugal through this PhD programme was acknowledged, as referred to in the recent evaluation of the national Agency for High Education (A3ES). The negative aspects mentioned in that evaluation were related to need of further involvement of other sectors from the UNL and to the need of enrolment of more students of higher quality. These aims are to be pursued with the proposed developments with new international cooperation and knowledge tracks (governance and health TA).

Conclusions

Post-graduation in technology assessment (TA) is a rather recent field and can be organised in several and different ways. Most experiences are related to the Masters' diploma level (2nd cycle of graduation in high education). There is only one graduation program at PhD level that is explicitly addressing TA. Some other PhD programs only include a few TA aspects in their overall structure. One main finding is that the labour market needs experts in the specialised fields of TA, of technology management, or technology innovation. A post-graduation programme is meant to fill an expertise gap between technicians, engineers, scientists, and the strategic decision makers or policy makers. The PhD programme on Technology Assessment (PDAT) in Portugal intends to prepare researchers and experts to perform leading innovation processes fostering economic growth and development. In that way it focuses on the methodologies and the analysis of processes of innovation, as well as of technological development in the general context of European and international frameworks.

Technology assessment, as a specific knowledge field with a theoretical corpus and its own set of research techniques, had no explicit doctoral programme until 2009. From then on, the first (and still unique) programme has been held at the UNL in Portugal with the collaborative involvement of ITAS (KIT), University of Liège, University of Frankfurt, University of Duisburg-Essen, University of Sofia, and other European universities. The general interest rose, but there is still a need to develop international cooperation, for example with Japan, Canada, US, Brazil, and other European countries.

Furthermore, the students of TA will develop specific competences and critical capacities to assess and synthesize new and complex ideas in a context of fast technological and socio-organizational changes. They will be able to promote, in an academic and professional context, the technological, socio-economic and cultural progress in a framework of a society based on knowledge and collaboration. The students in this PhD programme will be able to promote the participation in processes of integration of advanced knowledge of TA in innovative projects that can aim at the evaluation of technological and complex systems impacts, the establishment of new knowledge-intensive companies, either in the industry or in services, or to the establishment of innovation results or entrepreneurs' initiatives in already established firms or academic organizations. Original research work must lead to the generation of new knowledge, and the capacity to handle the correspondent methodologies of scientific research.

The establishment of partnerships with different institutional frames (Erasmus +, Horizon 2020, national settings) is one possibility, others are already on the way. For example, specialised tracks with joint partnership initiatives have been organised:

- Health technology assessment (with the University of Évora and the National Institute of Public Health)
- Governance and public participation (with the University of Liège)

This programme enabled the creation of a group of doctoral students who are highly competent and highly motivated to develop the field of study addressed by this doctoral programme. There is a strong internationalisation as well as networking activities developed by the doctoral students. This also resulted in the development of a solid sense of scientific autonomy among the doctoral students and a strong sense of responsibility towards their respective research communities. The start of an open national network (GrEAT) was a success and could also contribute to the institutionalization of the national Observatory of Technology Assessment in 2015. From the scientific point of view, regular publications in peer-reviewed journals in the last years have succeeded in providing visibility to this community.

This doctorate programme example clarifies the need for a higher level specialisation on TA, where a learning and research programme is offered to skilled professionals that feel the need for other tools to define new possibilities in the technology decision process in their institutions. The current PhD students of TA are working in high-tech departments of large hospitals, in large technology-based companies, in specialised software firms, or even in statistical departments related with innovation policy. And this is not an example from a large country with institutionalised TA structures, but a small country facing systematic economic and social problems derived from the financial crisis with strong limitations of investments in science and technology. For these reasons, TA competences are even more important where the resources are very limited. What has been achieved so far has been possible through the cooperation with other experienced institutions in this field and a strong network in research and teaching.

References: Page 443

openTA – A Web Portal Requiring Commitment

Knud Böhle

Abstract

After a short sketch of the history of the web portal "openTA" which is mainly serving the German-speaking TA community, the different services it provides are described. Also the design principles guiding the project are explained: openness, centralized & decentralized services, committed co-operation among TA institutions, and formal co-operation with other service agencies (national libraries, documentation centres). Constraints of the project are discussed and an outlook is given how to further develop the web portal. The main message is that a committed project team and advanced information processing is not enough to make an e-infrastructure a success. Commitment and engagement by users and by TA organisations at different layers is indispensable.

Background

The Network Technology Assessment (NTA) is a scientific association of scholars, experts, and practitioners from Germany, Switzerland, and Austria active in the broad field of Technology Assessment (TA). NTA was founded on 24 November 2004 in Berlin. The main objectives of the network are to support community building, to improve the co-operation among members as well as to strengthen the public visibility of the community and the relation with clients and the public. To this end, NTA is organizing, among others, annual meetings and biannual scientific conferences with professionally published proceedings. The thematic activities of NTA are based on working groups. One of these, the ICT Working Group of NTA, established and maintained electronic means of communication right from the start, in particular a mailing list and a website. However, there were almost no financial resources to further develop the services of the website. In this situation NTA, and especially its ICT Working Group, strived to raise funds, which eventually succeeded. Funding from DFG (Deutsche Forschungsgemeinschaft = German Research Foundation) from October 2012 to March 2015 allowed NTA to build up the web portal openTA (www.openTA.net).

Three units of the Karlsruhe Institute of Technology (KIT) constitute the consortium, bringing together three domains of expertise: ITAS, the Institute for Technology Assessment and Systems Analysis, the largest and longest-established TA institution in Germany, bringing in TA expertise; IAI, the Institute for Applied Computer Science (IAI) contributing with its technical know-how, and the KIT Library with its experience in electronic library and information services. Armin Grunwald (ITAS) is leading the project, Ulrich Riehm (also ITAS) acts as project coordinator.

Figure 27: Screenshot of www.openta.net
(slightly modified to fit within the page format) [27.04.15]

There are essential institutional interconnections between the openTA team and NTA members: Directors of the NTA member institutions committed themselves to support openTA, and NTA member institutions designated contact persons for the necessary everyday co-operation with the openTA team. Furthermore, the ICT Working Group of NTA acts as a kind of steering body, and the co-ordination team of NTA, in a way the governing board of NTA, is informed about and involved in decisions of openTA. No doubt: openTA is the web portal of NTA. Figure 1 shows the homepage of the TA web portal.

Seven Services

What has been achieved during the funding period of openTA is reflected in the services developed and implemented so far. At present, openTA offers seven different services:

1. Provision of Information About NTA and Its Members

Of course openTA provides information about NTA. This includes detailed information about the personal members (approx. 300) as well as the institutional members (approx. 50) from Austria, Germany, and Switzerland.

2. News Service

Since many websites of NTA affiliates provide latest news about research projects and publications through electronic newsletters or feeds (RSS or Atom), the idea to aggregate them was obvious. Hence the openTA News Service makes use of the feeds of NTA member organizations in order to automatically generate the widest possible overview of new activities of the NTA institutions. This service is running in routine operation since March 2014, gathering news items from 9 suppliers amounting to more than 1,000 news at the time of writing (May 2015). The openTA News Service is available at the openTA portal, as configurable feed, and as widget (implemented by four institutions).

3. Calendar Service

The openTA Calendar Service provides an overview of public events of NTA and its affiliates as well as information on further events with TA relevance. The import and export of calendar data are based on the iCalendar standard. Events can also be exported to private calendar programs (e.g. MS Outlook), but also the entire calendar service can be subscribed. At present six NTA member institutions make their events available in this way and two have implemented the corresponding “Calendar widget” at their websites. So far a total of around 400 events have been included in the openTA Calendar Service.

4. Publication Service

The openTA Publication Service compiles the publications of NTA member institutions and other TA-relevant sources in one database. Common bibliographic standards like MARC21, RIS, or BibTeX are used for the transfer and exchange of bibliographic data. The latter two are most appropriate when exchanging data with the NTA member institutions.

MARC21 XML, however, is common in the context of library databases (e.g. DNB and LoC). The mapping of bibliographic standard formats with the openTA metadata schema relies on Metafacture and the data transformation language Metamorph (Geipel et al. 2015). Internally, the publication data is stored in Elasticsearch (Drost-Fromm 2014), which also provides the search and filter options. Currently, six member institutions of NTA provide their publication data regularly. In addition, TA-relevant literature from the German National Library (DNB) has been included as well as an important historical dataset from the Library of Congress (LoC): all publications of OTA, the Office of Technology Assessment (1972-1995). Finally, social science literature on TA has been included from GESIS Sowiport. As of May 2015, the database references 21,000 publications.

5. Most Recent Publications Service

Up to now, there has been no service for the TA community announcing the most recent publications in the interdisciplinary field of TA. The monthly openTA Most Recent Publications Service now provides a quick overview of relevant new publications. Currently the only source for this service is the National Bibliography of the German National Library. The database is searched on a monthly basis with a complex query and the output is automatically imported. The hits are then evaluated and further selected with respect to TA relevance. The remaining records are further classified attaching them one of twenty categories. Experience tells that from approx. 300 hits retrieved, about 50 are incorporated in the Most Recent Publications Service.

6. Blog

The openTA Blog is open for statements and comments of interest for the TA community. Writing blogs and commenting takes time. Therefore it comes as no surprise that until today only 16 blog entries have been posted. The quality of the content and the relevance for the TA community are worth mention. It also seems that the willingness to comment is increasing bit by bit.

7. NTA Mailing List

The mailing list of NTA is older than openTA and not a service of openTA in a strict sense. However, content of the web portal is often announced via the list and information that is first sent to the list is later incorporated in the respective services of the web portal. The NTA Mailing List (NTA@LISTSERV.DFN.DE) is open to everyone, and it is not moderated. All posts by its registered participants are sent directly to all the participants of the mailing list. The posts are archived. Subscription to the mailing list neither requires membership of the "Network TA" nor an account at openTA. Currently there are around 500 subscribers.

Four Design Principles

In the following four design principles are highlighted which guided the project and the implementation of the services: openness, central aggregation combined with decentralized

tailored re-use of services at the level of a single institution, committed co-operation, and the principle of extending co-operation beyond the TA community teaming up with non-TA information infrastructure institutions.

1. Openness

As the name of the project openTA already reveals, the overarching principle is openness, meaning: open content, open standards, open source software, and open innovation in the sense that different types of stakeholders and users are able to influence the design and development process.

2. Centralization/Aggregation and Decentralization/Tailoring

Looking at the IT infrastructure and the websites of the NTA member institutions, a wealth of heterogeneous and distributed resources appears. Making use of the distributed resources in order to build common online services is one aim of the project, which should not be separated from the second aim: to make the services available at the institutions' websites tailored to their needs.

The benefit of aggregation and a one-stop approach to the resources of the TA community is easy access and an increased visibility of the TA community and its research for politicians, scholars of related disciplines, industries, the interested public, etc. But at the same time a merely centralized approach is not enough, because TA units want to remain distinguishable and they want to create traffic at their organizations' websites. No one wants to be an anonymous contributor to a network. Therefore the principle of aggregation has to be complemented in two ways: first by giving due credits to the institution providing the information at the web portal for each and every item (e.g. news, publications). This also means that it should be possible to filter (de-aggregate) the aggregated information at the web portal by institution. Secondly, the services need to be portable and tailorable so that each institution can re-use them in line with its preferences. Export functions, feeds, widgets, and open standards are the technical means for this type of decentralized services.

The equally centralized and decentralized orientation, or, in other words, the combination of aggregation and tailoring, is the most innovative core and the special challenge of the openTA project. This approach goes together with a specific incentive structure: the more an institution contributes to the portal services, the more it can use the web portal as a showcase; the better the aggregated services are, the more attractive it gets to integrate them at the local level. This incentive structure is also essential from the point of view of NTA members to make the portal services sustainable.

3. Committed Co-operation

The third principle is committed co-operation between the openTA team and the colleagues at the member institutions of NTA. Commitment is needed at different levels. First the directors of NTA member institutions have to be committed to the project expressing their support. In the case of openTA, more than 50 percent of directors (23 out of 40) wrote letters of intent indicating their willingness to co-operate in the project. Today (May 2015) 12 member institutions (Difu, EA, FhG-ISI, IBM Basel, IÖW, ITA, IZT, KIT-ITAS, Öko-Institut, TAB, Uni Bremen FG Technikgestaltung, Wuppertal Institut) do actually contribute to the openTA services.

Establishing and maintaining co-operation is not always easy. The difficulties lie in the lack of resources, poor data and IT equipment, not enough institutional support by the hierarchy, "reservations" by institutions which do not consider TA as their main business and perform technology assessment among others – even if it is obvious that they contribute significantly to the field of TA. It is also very important that a person at the member institution is assigned by the hierarchy to spend time on the co-operation with openTA. The co-operation effort for institutions with advanced IT infrastructure (databases, web platform, services) and competent personnel is comparatively low, but there is still a considerable amount of work involved. For other (technically less advanced) institutions the burden will be even higher. But in these cases this higher effort might be worthwhile since co-operation with openTA might be an opportunity to update IT services and to turn to common open standards. Common standards are indispensable for a smooth transfer of data and metadata in both directions between openTA and the member institutions (e.g. Atom/RSS, iCal, BibTex, RIS, DC, OAI-PMH, Marc21, etc.). The responsibility for the quality of the data provided lies with the member institution providing the information.

Successful co-operation requires face-to-face meetings and personal exchange about the particular demands, constraints, and opportunities at each member institution and about the support the openTA team is in fact able to provide. Committed co-operation involving trustful mutual learning is the second cornerstone of the openTA portal's sustainability.

4. The Principle of Co-operation Beyond the TA Community

TA is interdisciplinary and relates to various other fields of research like sustainability research, environmental research, innovation studies, social studies of science, sociology and philosophy of technology, sciences, etc. Some of the disciplinary fields have already established an infrastructure for information provision and communication services. Furthermore, there is a general information infrastructure in place serving many disciplines and fields of practice – think of the national libraries or huge databases of research literature offered by commercial publishing houses. In these cases the task of the openTA project is to get access to the TA-relevant parts of this information on the basis of formal co-operation agreements. There are two examples of this type of co-operation beyond the TA community.

First, in co-operation with GESIS – Leibniz Institute for the Social Sciences, the largest centre supporting sociological research in Germany, openTA produced an open access TA bibliography from the GESIS database, selecting the sociological literature dealing with TA from 1978 to 2013. This annotated bibliography (Böhle 2014) is distributed online and in print by GESIS, is available at the openTA Portal, and the 655 records were also fed into the publication database of openTA.

Second, openTA is co-operating with the German National Library (DNB). There is a monthly flow of literature references from the database of DNB to openTA, containing records with the keyword "technology assessment" and synonyms. Also a rather complex search in the database of DNB is automatically performed on a monthly basis aiming to identify most of the "TA-relevant" literature. The hits of this broad search, some 300 hits per month, are checked by TA experts with respect to their TA relevance and usually about 50 records per month qualify for the Most Recent Publications Service and are added to the publication database of openTA (see above).

Discussion

The infrastructure openTA is aiming to develop step by step to the benefit of the TA community is not self-propelling and needs committed co-operation as explained above. At present, not all of the now 50 institutional members of NTA are actively contributing. What could be done to improve this situation? Why do not all researchers and institutions consider the need for a central/decentralized web portal for TA that urgent?

One tricky point is that openTA, like any other dedicated web portal or web resource, is competing with the general e-infrastructure already in place: the Internet with search engines easing access to a multitude of websites and public as well as commercial services. This basic e-infrastructure is certainly used by those interested in TA issues too. Against this background, openTA must be understood as a value-added e-infrastructure component or a value-added community network. Of course it is not easy to compete with the basic e-infrastructure and to achieve positive network effects (regarding users and TA institutions). The added value depends on the commitment and the efforts of its members (with as much automatic routines and procedures as possible), and this implies that the members of NTA are convinced that the web portal is an interesting showcase for their public activities and that the openTA services incorporated at their websites at the local level enhance their own web presence.

Internationalization is the next tricky point. Co-operation with information providers from other countries (e.g. the British Library and the US Library of Congress) is on the agenda and considered a good idea. At the level of publication services there are no reservations to extending the wealth of sources. And in fact, today many items of the publication service are already in English, e.g. the OTA legacy at the Library of Congress.

Co-operation of openTA with international TA projects and associations like PACITA (cf. Riehm and Nentwich 2012) and EPTA is ongoing. Looking at the potential follow up of PACITA, one can envisage openTA as one node of a future international TA infrastructure and one can imagine that openTA's technical solutions and design principles were taken into account for such an endeavour.

However, the idea of scaling up openTA to a truly international TA portal would hardly work. Assuming that the design principle of committed co-operation is indispensable when building up a TA portal, it will be difficult to put it into practice at an international level. As the openTA experience has shown with respect to TA institutions of three countries sharing the same language, it takes a lot of personal discussions and face-to-face meetings to find the appropriate level of commitment, to have detailed understanding of the data resources, the software and hardware employed, the specific skills in place (or the lack of it), and the organizational constraints. Expanding the number of countries would mean expanding the number of languages, the number of hardware and software configurations employed, the institutional frameworks, and so on. Certainly, these conditions will not make things easier.

Outlook

Funding of openTA by DFG ended in March 2015. There are, however, possibilities to get additional funding from DFG and a corresponding proposal is in the making. Proposing to expand and consolidate the existing openTA services will not be enough to raise new funds. Some new ideas are currently under discussion:

- Co-operation with further information providers, integrating new information sources, e.g. data from the British Library and LoC;
- Hosting an interactive, high-quality peer-reviewed online journal at openTA;
- Co-operation with social media (like Wikipedia) and academic social networks (like academia.edu, ResearchGate, RePec) in order to strengthen the presence of TA and the TA community in these networks;
- Alternatively, a kind of Social Media TA Watch could be envisaged. This service would try to find TA-relevant activities and resources within social media and networks and make them available for openTA and its users;
- Provision of specific applications and tools useful for the TA community (e.g. an online Delphi tool or a dialogue platform for online deliberation) at openTA;
- Development of a concept for an openTA research data service.

These are just some of the ideas deserving further discussion and concretization.

References: Page 444

POTENTIALS AND CHALLENGES OF A PROSPECTIVE TECHNOLOGY ASSESSMENT

Articles from the PACITA 2015 Conference Sessions:

(28) Potentials and Challenges of a Prospective Technology Assessment

Potentials and Challenges of a Prospective Technology Assessment

Introduction to the Session

Wolfgang Liebert, Jan C. Schmidt and Bernd Giese

The further acceleration of technoscientific dynamics—together with the strong ambivalence of technological advancement—challenges established concepts of TA and, particularly, calls for earliness (cf. contribution of Liebert and Schmidt, in this volume). But the attempts to introduce and implement technology assessment (TA) in the early phases of the technoscientific development are often regarded as inconsistent with the Collingridge dilemma. The “dilemma of control” says that predictions of consequences are (more or less) impossible at early stages of a certain technoscientific development—whereas later, when problematic consequences have become obvious, changes are not possible anymore or at least expensive, difficult, and time consuming. However, the main message of Collingridge’s famous book *The Social Control of Technology* is that we can find ways out of the dilemma (Collingridge 1980). Collingridge proposed criteria to avoid being trapped in the dilemma: corrigibility of decisions, controllability, maintaining flexibility/alternatives, and robustness to errors. These requirements can enable procedures for shaping technology, or at least directing socio-technological innovation, even when a certain technology is in its infancy, and thus opening the door for a prospective approach in TA. Collingridge´s work should, therefore, make us feel more encouraged than depressed (cf. Liebert/Schmidt 2010b).

In recent years, TA scholars have explicitly worked on early stage procedures or even on conceptual proposals, aiming to achieve a prospective approach. In addition to prospective technology assessment (ProTA; Liebert/Schmidt 2010a) there are concepts such as vision assessment (Grin/Grunwald 2002), real-time TA (Guston/Sarewitz 2002), constructive TA (Schot/Rip 1996), technology characterization (Gleich 2004; Giese et al. 2015), hermeneutical TA (Grunwald 2012), early technology analysis (Zweck 2002) and, more generally, innovation and technology analysis. The common denominator of these efforts is the emphasis on early stage orientation.

The aim of the session was to facilitate and foster the prospective approaches in TA by deepening underlying conceptual reflections. In our view such approaches should address the technoscientific character of fields of concern, reflect on the corresponding potentials and intended impacts as well as unwanted but expectable consequences, and consider questions on how, in the context of precaution, to deal with different forms of uncertainty (known unknowns, unknown unknowns). Furthermore, normative dimensions need to be addressed, explicated and explored. Otherwise it is impossible to choose and justify criteria used for assessment and judgment in the R&D stage. We can, therefore, hardly avoid referring to ethical concepts. In order to enable a shaping of technology, in addition, consideration of the technoscientific core, including a shaping orientation of this core, is indispensable. Furthermore, the various players and stakeholders – from scientists and engineers over politicians and industrial managers to citizens and consumers – and their different interests need to be taken into account.

The point of departure of the session was not solely *whether* we should have a more explicit prospective perspective in TA but *how* we could sharpen and further develop TA in order to increase its prospective capabilities and capacities to facilitate an early shaping of technology: *Shaping TA in order to shape technoscience*. From this perspective, a threefold task seems to be necessary:

First, a systematic and anticipatory analysis of technological development, related research, and eventually also science with respect to, for example, the potentials, desired impacts, unintended consequences, and risks enabling an early assessment of technologies.

Second, a type of knowledge production which helps and supports the creation of responsible outcomes of R&D and which can facilitate the selection of responsible research paths and corridors.

Third, the development, usage and implementation of concepts as to how to enable reflection and participation at an inner-scientific level and even more at a societal level.

The initial point of the three organizers of the session was, and still is, that many scholars in TA aim to proceed in this direction. Although they differ regarding the terminology and the conceptual framework, it might be helpful, interesting, stimulating, and mutually supportive to invite to an exchange of views and to a reflection on the potentials and challenges of a prospective approach.

Five types of questions might foster and facilitate the search process towards a prospective TA:

First, the objective, goal and results: What should be the objective, the goal and the desired results of a prospective TA? What would we like to accomplish in detail? What is it realistically possible to achieve?

Second, the semantic core, the definition, and classification of a prospective approach: What is prospective knowledge? What types of future oriented knowledge can be distinguished? What is the difference between projective-predictive, explorative-experimental, normative-teleological and visionary-speculative knowledge of the future, or of prediction, forecast, projection, foresight? How does this kind of knowledge refer to time, to modality and temporality? How do descriptive and normative elements come into play here?

Third, the justification, substantiation and rationale of prospective knowledge: What are the criteria to justify prospective knowledge? How can we distinguish prospective knowledge from mere speculation (e.g., in the speculative ethics debate, cf. Nordmann 2007)? Is scientific evidence useful for a prospective analysis of technologies? If it can be taken into account, what is the acceptable relationship between the dimension of potential hazardous outcomes and the effort to gain evidence of these effects? And – besides scientific evidence – is probability a potential complement especially with regard to 'reasons for concern'? Can we rely on reasons for concern without having scientific evidence?

Fourth, levels of reflection and themes of consideration: Which various levels of reflection (about what) are necessary or indispensable? For example:

- related to the scientific, research and development communities themselves
- concerning the technoscientific objects
- informing about embedding the socio-technical world in the socio-economic context
- investigating interests and motives
- clarifying normative principles and ethical assumptions
- highlighting forms of participation and democratic rules
- taking the need for regulation, legislation and new forms of governance into account
- discussing relations between reflection and action

Fifth, procedures, methods and organization: How can such an interdisciplinary and integrative process to achieve prospective knowledge be organized and facilitated? Is there – beyond the various case studies – an integrative methodology? These questions are asking for concepts, procedures, tools, methodological approaches, which are already available, which should be further developed, which could be combined or which must still be invented.

The following contributions are addressing these questions from different perspectives. Although they vary in their methodological background, all aim at a reflection and revision of well-established TA concepts in order to facilitate a prospective approach to (not yet fully carried out) technoscientific programs. They share the vision that the time has come to identify a novel way to reconsider and to further develop TA.

References: Page 444

Demands and Challenges of a Prospective Technology Assessment

Wolfgang Liebert and Jan C. Schmidt

Abstract

The objective of this paper is to outline, elaborate and further develop the concept of prospective technology assessment (ProTA), which has become one theoretical framework of present-day TA. The point of departure of ProTA is a fourfold diagnosis of the recent situation that any type of TA is faced with: technosciences, ambivalence, governance and non-dichotomy of science and society. Based on this diagnosis, the approach, concept and method of ProTA will be sketched, encompassing a fourfold orientation: (a) early-stage/earliness orientation, (b) intention and potential orientation, (c) shaping orientation and (d) orientation towards the technoscientific core. It will then be shown which type of future knowledge ProTA provides, and how ProTA is linked to ethics. In this paper it is argued that an ethical framework is necessary to conduct any kind of TA. The paper concludes by briefly presenting two case studies of ProTA projects that underline the methodology of ProTA.

Diagnosis

Early assessment has always been a focus of technology assessment (TA) (Grunwald 2002). The goal of this paper is not to reinvent the wheel. However, in light of the recent transformation of the science, technology and innovation system, a reconsideration of the underlying assumptions might contribute to the advancement of TA. The transformation poses both challenges and opportunities for TA. One variant of TA that tackles these challenges and grasps the opportunities is the concept of Prospective TA (ProTA) (cf. Bender et al. 2004, Liebert et al. 2005, Liebert/Schmidt 2010a, Liebert/Schmidt 2010c). The point of departure of ProTA is a fourfold diagnosis:

First, technoscience diagnosis: Today, pure basic research and purposeful applied research, and also scientific and technological knowledge are highly intermingled. In the current scientific-technological world, there is no clear distinction between scientific and technological research; early-purpose orientations migrate deeply into science. TA should (and can) therefore contemplate not only shaping technology but also assessing and shaping science and research itself. Without including the research process, TA will become ineffective; TA will be inadequate for the current technoscientific dynamics. This circumstance poses an earliness requirement on TA.

Second, ambivalence diagnosis: Scientific-technological progress is increasingly revealing ambivalences. A clear distinction between "positive" impact and "negative" consequences hardly seems possible at all. Is an intended impact always unproblematic? Could the excessive success of an intended impact of research and technological development turn out to be disadvantageous? There is "internal ambiguity" and a non-eliminable "ambivalence" in technological advancement: problematic consequences are inherently intermingled with the intended impact and goals being pursued – as the two non-reducible sides of a coin. This can certainly question "good" intentions. Science and technology are ambivalent in their core. It is therefore necessary to continuously (in "real-time") put the research together with all the intended, contemplated and possible outcomes on the test stand; TA should focus on the intentionality and potentiality of research and technological development.

Third, governance diagnosis: The technicisation of society and the life-world as well as socialisation of technology characterise late-modern societies. The optimism prevalent in the 1960s and 1970s, which held that these processes can be planned, steered and effectively controlled, is gone. Science, technology and society are intertwined in a great variety of ways. Many scientific and non-scientific actors and stakeholders are involved in defining research and technology programmes. New concepts and approaches, such as governance, engender hope that – instead of steering research from the outside – shaping procedures that reflect as much as possible on scientific development itself could improve scientific-societal co-activity.

Fourth, non-dichotomy diagnosis: The traditionally presupposed dichotomy between science and society is, evidently, being increasingly called into question; boundaries – if they ever existed – are dissolving. Science-internal epistemic paradigms on the one hand and science-external value and problem horizons on the other cannot be separated from each other. What was formerly regarded as excludable and framed as being external to science has an impact on science, and has had for a long time. The various aims pursued by science and technology cannot be defined just on the inside or be set in advance from the outside. A TA approach that is opener to the potentialities related to research programmes could play a mediating role between science and society. In order to achieve this mediating effort, the black box of science and research needs to be opened; to accomplish this, a deeper knowledge of the sciences is necessary.

The fourfold diagnosis challenges four types of assumptions of well-established concepts of TA: First the innovation theory assumptions, second the ethical-utilitarian assumptions, third the action theory assumptions and fourth the assumption regarding the what and how of sciences (cf. Liebert/Schmidt 2010c). These challenges have induced an intensive discussion about the appropriate methods and concepts of TA. In order to cope with these challenges, novel TA concepts have been proposed. Prospective technology assessment (ProTA) is one such concept, which is surrounded by a family of – at least in some aspects – cognate concepts such as vision assessment (Grin/Grunwald 2002), real-time TA (Guston/Sarewitz 2002), constructive TA (Schot/Rip 1996), technology characterization (Gleich 2004), hermeneutical TA (Grunwald 2012), early technology analysis (Zweck 2002) and, more generally, innovation and technology analysis.

The Concept of Prospective Technology Assessment

ProTA can be regarded as an extension, expansion or widening of established TA concepts by focusing on specific elements that are (somewhat) underexposed in the existing concepts. The approach of ProTA encompasses a fourfold orientation (cf. Liebert/Schmidt 2010a):

First, early-stage orientation: Research and development is one basic driving force towards the future. The technoscience thesis highlights the relevance of science throughout the entire innovation process. ProTA aims to advance reflection on technology in the early phases of the innovation process – to be precise, on science and research. The research and development process cannot be regarded as a linear chain, but might be framed from the complex, nonlinear and interactive perspective of actor-network theories. In light of such interconnectivity, the relevance of research processes and scientific knowledge production within specific projects and programmes cannot be overestimated. Thus, the point of departure, as well as the main object with which ProTA has to deal, is science or technoscience, and not just technology.

Second, intention, potential and vision orientation: According to the ambivalence and the technoscience diagnosis we find intentions, goals, visions and objectives, as well as deliberate discussions on norm setting and method justification, already within the inner structure of science. Considering and assessing intentions and potentials is a key element of ProTA: We know – or at least could know – much at the beginning of research and development processes, i.e. during the early phases of agenda setting and the development of research corridors. In many cases, negative side effects and risks can be identified very early on; prospective knowledge of and early anticipation of unintended consequences are feasible. Many present-day and future technologies are based on a predecessor technology or on a synergetic combination of already-established technologies: we can know much already within the research process. Knowledge about the future can be derived from the state-of-the-art in the technosciences by analysing declared intentions, norms, preferences and purposes in current research, and by considering future scenarios. We are able to generate knowledge about intentions and intended impact of science as well as about potentials, uncertainties and anticipatable unintended consequences. The precautionary principle, risk assessment procedures and risk regulations have been implemented in order to deal with uncertain but nonetheless relevant knowledge (e.g. REACH). ProTA states that we can assess the present's future. In doing so, ProTA aims to facilitate the public and inner-scientific discourse on the intentions, potentials and visions of a novel and/or expanded technoscientific field.

Third, shaping and alternative-path orientation: ProTA also responds to the governance diagnosis and to the non-dichotomy diagnosis. These diagnoses call into question the externalist perspective and the assumptions of classic action theory – which are most prominent in the mechanistic notions of "control" and "prediction". According to these diagnoses, inner-scientific goals and procedures are inherently interlaced with societal and economic purposes external to science. The boundary between the inside and outside of science is becoming blurred. The "black box" of technoscientific research can, therefore, be opened.

The trajectories of an R&D programme can be addressed in order to enable a shaping of technosciences. This will entail more than solely avoiding pernicious risks; it will also include deliberate processes to positively determine what deserves to be researched and what is technologically desirable. This orientation of ProTA also refers to the “structure of path alternatives” underlying the post-paradigmatic and post-normal scientific endeavour. Scientists and engineers themselves are actively involved in this process. ProTA is, therefore, a kind of participatory research – not just (social science) observation from an outer (distant) perspective. ProTA supports a greater participation of science and public stakeholders in order to obtain transparency about internal and external technoscientific processes, about facts and values, and about potentials, intentions and visions.

Fourth, orientation towards the technoscientific core: The shaping orientation is based, at least to some extent, on the production of information to enable assessment of whether particular technoscientific and non-technical alternatives would be feasible. Future knowledge of this kind is highly relevant to supporting decision-making procedures. In addition, ProTA is aware of the fact that not only rational arguments, but also visions, promises and speculations play a major role in influencing research trajectories and path decisions. The visions as well as their underlying values can and ought to be disclosed and, if necessary, criticised and modified. To this end, a deeper knowledge of the technoscientific core is indispensable. The state of current research and the inner-scientific dynamics have to be scrutinised, also in order to clarify the extent to which there is potential for the visions to be fulfilled. Technoscientific knowledge can provide the kick-off for discussions regarding technoscientific potentials, intended impact, expected results and non-intended consequences. Of major importance in this context is the consideration and assessment of technoscientific (realistic) potentials and their demarcation from (unrealistic) visions and promises. For this purpose, various kinds of non-knowledge – e.g. uncertainties, ignorance and risks – have to be taken into account.

From a methodological perspective, ProTA is based on the fourfold orientation framework described above. ProTA proposes this framework for TA scholars, and its use should provide policy makers as well as scientists and the broader public with relevant information and means of assessment with regard to technoscientific programmes and the various related processes. The objective is to recognise and reflect on the ambivalences, to frame problematic issues, to pose questions that can be addressed to the active stakeholders, and to figure out sound decision points to enable a deliberate shaping.

Future Knowledge

Although the concept of ProTA hardly considers the future explicitly, implicitly the future is ubiquitous in the first three orientations in one way or another. ProTA anticipates the future in order to enable path decisions and to shape the technoscientific core. However, the future can be thought about and conceptualised in different ways. The scenario method – which is well-established in TA and in TA-related concepts – can serve as a paradigm to clarify and classify different approaches towards the future (cf. Liebert/Schmidt 2012; Beecroft/Schmidt 2012). At least four different “ideal approaches” to the future can be distinguished, and ProTA refers – in one way or another – to these “ideal approaches” or ideal types.

First, the projective or predictive type of future knowledge: This type describes extrapolations of historical trends and projections of the past into the future. It is therefore based on the assumption that the future is to some degree or in some aspects predefined by the past. In a strong form of the projective type, it follows the assumption of an (ontological) existence of laws determining the development of socio-technical systems. This assumption brings to the fore a problematic proximity to the paradigm of technological determinism, which leaves only few options for human decisions. If prognosis, based on causality, is possible, then decisions are not. In intermediate forms, the only necessary assumption is a ceteris paribus clause: If none of the relevant conditions of the system in question are altered in the time span discussed, there is a specific probability that a specific future state will evolve. Differences between scenarios result merely from uncertainties in the description of the present and past or in the causal laws derived from these descriptions. ProTA rejects strong forms of the projective or predictive type of future knowledge; however, weaker forms of this type can play an important role, in particular if they aim to inform about or criticise the consequences of business-as-usual strategies.

Second, the explorative-experimental type of future knowledge: The experimental type is used in order to open up and analyse the “sphere” of possible futures. Present decisions and actions are analysed as the main driving force, each opening up different pathways into the future – and closing others. Assumptions regarding causal mechanisms in socio-technical systems are necessary as well, not to predict the future, but to establish different futures as the result of different actions or unexpected system changes (wild cards). The experimental type of future knowledge aims at broadening the spectrum of possible actions in an open future. The explorative type of future knowledge is based on a causal structure: if we do x today, we will reach the state of y in the future. Starting from the present, a sphere of possible futures is unlocked and opened, and can be analysed as to whether they are more or less desired alternatives. In a descriptive form of this type of future knowledge, assessment of the options is not part of the method itself, but is externalised. In a normative form, value judgements are a central element of the method and can be assessed and reconsidered in the process as well.

Third, the normative-teleological type of future knowledge: This explicitly normative type focuses on aims, intentions, desires and values – and is closely linked to the intention orientation of ProTA. Means are identified according to their potential for contributing to the aims. Such a mindset about the future is frequently adopted within the scope of the scenario method. Two forms of the normative-teleological type, also predominant in the scenario method, can be distinguished: one form works backwards from a desired future state in order to identify development paths that might lead up to it from the present (backcasting). The other form starts in the present and thinks through many different courses of action trying to find a path to the desired future state (strategic gaming) and optimising the strategies by a process of trial and error. The normative-teleological type of future knowledge shows an inverse temporal structure: To achieve a state of y in the future, x has to be done today. Strong forms also reflect on and (probably) revise the aim, while including it in the evaluation and assessment (reflexivity), whereas weaker forms are slightly more instrumentalist: they only seek means leading to ends which are set in advance.

Fourth, the visionary-speculative type of future knowledge: This type puts visions and speculations at the centre. Related models could be predominantly technology-driven, or they could convey or explicate desired societal futures and delineate new technology, new forms of existing technology or alternative technological usages which can lead to the achievement of predefined objectives. To some extent, this type of knowledge can be linked to an extreme form of the intention orientation of TA, underlining the different kinds of intentions and visions that should be distinguished and scrutinised.

These four ideal types of future knowledge describe core points of the whole spectrum of different ways of thinking about and conceptualising the future. ProTA mainly refers to the normative-teleological type – which seems to be inherently linked to the intention orientation of ProTA. In addition, ProTA also considers a plurality of futures – and, thus, elements of the explorative scenario play a role as far as they help to reflect the alternative-path and shaping orientation. Visionary approaches are helpful if they focus on enabling reflection on societally desirable, new socio-technical realities: cultural change and great transitions are based on this way of thinking about the future. ProTA does not favour a projective-predictive approach in a narrow sense, including mechanistic and strictly deterministic causality assumptions, but as part of a teleological, explorative and visionary structure to shape and deal with the future.

Normative Framework and Ethics

In its core, ProTA is reflexive-normative. Its normative fundament is part of the orientation framework and has been delineated by referring to two criteria based on philosophical considerations (Liebert et al. 2005, Liebert/Schmidt 2010a). The first criterion is Hans Jonas' principle of responsibility, which is related to a "heuristic of fear" (cf. Jonas 1979). We associate that with a "preservation principle" (Prinzip Erhaltung) aimed at achieving a "conservative" preservation of our life world and "genuine human life". The second criterion is related to Ernst Bloch's utopian principle of hope, which addresses the "open horizon" of the future (cf. Bloch 1959). Such an "unfolding principle" (Prinzip Entfaltung) is aimed at an "alliance technology" which serves mankind and is concurrently in harmony with nature. We are striving to explain ProTA's normative framework by sounding out some elements of the most common concepts of ethics (cf. Liebert/Schmidt 2015).

Jonas' term to describe responsibility is non-reciprocal. The crucial aspect is not the responsibility between equals, but the asymmetric responsibility for somebody/something, for others: it is a responsibility for other humans, for future generations, for animals, embryos or nature. This concept also encompasses the responsibility of scientists for other human beings, i.e., those who are affected by research outcomes, and for the natural environment.

The "so-being" of the world calls us to preserve it, as already existent. Accordingly, one can ask in concordance with Jonas: Does the ethics of science and technology contain indisputable core elements, which are materially (content-based) well formulated in a way that they are beyond deliberative ethical discourses between equal participants discussing in mutual recognition? If so, Jonas' call to secure the "permanence of genuine human life" with "respect for what humankind was and is" has to be clarified. A first attempt could read: all that concerns human life should not come under threat by technoscientific advancement. It would be consistent to move ethical reflection forward into the cognitive and scientific process. Ethics and epistemic knowledge gathering would no longer be regarded as being strictly separated from each other. The pressing question concerning responsible innovation through research could already be debated within and throughout the research process, as well as outside the scientific community. A concept of this kind could be called an "ethics of approach to the future" that belongs to the tradition of deontological ethics (Zugangs-Zukunfts-Ethik, cf. Schmidt 2014).

Is it possible to find an analogous way to further underpin the unfolding principle and the preservation principle by referring to a common ethical concept? Can we refer to the well-established notion of so-being when assessing the future unfolding of mankind and its technology? Certainly not. The important matter is to positively define desired tendencies of scientific-technological progress. The current so-being is the basis, but we are faced with forward-looking decisions about what is possible beyond what already exists. It is also a matter of determining how we would like to live in the future, while acknowledging the plurality of different ways of life today. Science and research play an utmost important role in such decisions today. What needs to be accomplished is to make technoscientific options and related value decisions more transparent through suitable approaches of TA. One prerequisite is, therefore, to address the technoscientific core. What we need is a conscious navigation within the huge realm of possibilities defined by scientific-technical potentialities, (law-obeying) nature and societal dynamics. To enable a value-oriented process, explicit reflection on ethics and normative backgrounds seems to be indispensable. Unfortunately, universal and concrete criteria beyond inner-scientific and risk avoiding aspects are lacking today. Yet, the world-changing outcomes of research concern us all. Indeed, this is the field of discourse ethics (Habermas 1991). Discourse ethical procedures claim they could guide such deliberative considerations: In a common discourse encouraging a mutual recognition of interests and sense of values, we should debate and examine what is universally acceptable and what is not. Such discourse must not necessarily lead to consensus. Well-founded and transparent dissenting opinions could also be helpful and could provide the basis for individual, institutional and political decisions, which should always be structured in a reversible manner.

Besides elements of deontological and discourse ethics, as discussed above, utilitarian concepts (cf. Höffe 2013) are also indispensable for finding an ethical framework for TA.[1] Considering consequences is inherent to utilitarian approaches and therefore certainly of relevance for TA, which inquires into the intended and unintended consequences of scientific-technological action. In addition, utilitarian arguments underline that good intentions and convincing justifications of scientific action are not sufficient. Among the specific considerations that definitely deserve attention in regard to responsibility and ethically warranted action are the result and outcome, the success, the failure or the damage caused – even if this usually can only be defined ex post. However, stressing the relevance of considering the outcomes implies – conversely – that the motives, intentions, visions and interests (related to scientific action) are somewhat under-exposed. A major disadvantage of the utilitarian approach of choosing between conflicting benefits is that this focus can prevent us from posing fundamental questions. Furthermore, utilitarian perspectives often promote the seizing of so-called chances in the absence of proven risks, and thus, a tendency is becoming visible to annul the balance between "preservation" and "unfolding", which we take into account for ProTA.

To summarise, ProTA includes elements of the most common concepts of ethics and integrates these pieces in a certain way. ProTA fills the deontological concepts with material-normative content (some would call it "metaphysical content") related to the preservation principle, which was proposed by Hans Jonas, among others. Discourse ethics is central insofar as it enables a deliberative goal and vision setting process related to the unfolding principle that was proposed with reference to Ernst Bloch. In addition, utilitarian-consequentialist thinking might be indispensable – at least to some extent – in order to appropriately include outcomes, consequences, decisions and actions related to concrete research programmes. In any event, ProTA can hardly avoid an underpinning by ethical concepts.

Examples and Conclusion

The challenge for ProTA is not only to suggest a convincing orientation framework that addresses the fourfold diagnostic analysis of present science and research dynamics, but also to show that this concept is methodologically applicable. During the last decade a number of TA projects have been conducted by adopting the guidelines and the orientation framework of ProTA. Although not all pressing issues and TA challenges can be tackled by Pro-TA methodology, a broad variety of technologies might be accessed and assessed. These at least include technoscientific fields such as (1) nuclear technology research, (2) energy research, (3) nano-technosciences, (4) synthetic biology and (5) neuro-enhancement/pharmacotechnology. Let us briefly consider two examples:

The first example is taken from projects on future nuclear technology research: these concern larger research and development programmes in several countries, in particular in Europe, aiming to enable the building of fusion and Generation IV fission reactors (Liebert 2007, Liebert/Schmidt 2010a). Since the objective of such application-oriented R&D is to enable "new" types of nuclear reactors, it cannot be classed as pure or fundamental research. On the contrary, such programmes are illustrative examples of technoscientific research. Paradigms of fundamental physics are relevant, but heuristics and extended modelling and

simulation (far more than pure theory and analytically closed solutions for the underlying physical problem) are central to enabling giant new nuclear machines and explaining the real phenomena occurring therein. (1) Early-stage orientation: R&D aimed at realizing such reactor systems already began in the 1950s or in some cases in the 1960s. Results are promised for a time 20 or 40 years from now. Early-stage orientation of ProTA seems to be possible and necessary. (2) Intention orientation: The declared intentions of developers include inherent safety, sustainability, proliferation resistance and economic attractiveness, thus promising convincing alternatives to existing fission reactors. Based on our experience with fission systems and on the variety of risks involved so far, it ought to be possible to examine the degree to which improvements over existing systems might be achievable. (3) Shaping and alternative orientation: The design of such future systems allows broad freedom of choice in terms of which specific technical and physical principles to use for their components, how the system should actually be realised and which materials to introduce. Many of such aspects need to be decided during early stages of the development and design process – or still are awaiting a clarification by technoscientific research; however they have an impact on what safety characteristics, what non-proliferation features, what nuclear waste characteristics and what kind of economic prospects could be achieved. A prospective assessment of such potential is urgently required to avoid disappointing results from very expensive R&D. (4) Technoscientific core orientation: The promises of most of the future nuclear systems depend heavily on the development of new low-activation materials that can withstand the bombardment of, for example, high-energetic particles, enormous heat, and heat-load changes. Is it possible to find or develop such materials? This is one example of how ProTA is challenged to examine the technoscientific core of future nuclear technology research. There is a kind of "circular loop" between technical potentials, fundamental knowledge, intentions, interests, purposes and technological visions – ties that are co-produced by researchers, interested companies and policy makers. Besides the more fundamental critique by NGOs, TA has the task of providing transparent information and an assessment in order to enable an orientation framework to improve decision making inside and outside science.

Another example that illustrates how ProTA can successfully be applied can be taken from the analysis and assessment of synthetic biology (Schmidt 2012; Schmidt/Liebert 2014; Schmidt 2015). Synthetic biology seems to be one novel crystallization point of late-modern technoscientific hype and hopes. In 2010, the researcher and entrepreneur Craig Venter announced the forthcoming advent of an epochal breakthrough and envisioned a fundamental shift in our technical capabilities. Synthetic organisms "are going to potentially create a new industrial revolution if we can really get cells to do the production we want; […] they could help wean us off of oil, and reverse some of the damage to the environment like capturing back carbon dioxide" (Venter 2010). ProTA is effectively helpful in analysing the intentions, visions, and speculations brought up in the discourse on synthetic biology. (1) Early-stage orientation: Synthetic biology is in a very early stage of the innovation process. At the moment it is rather unclear what kind of visions will and can (technically) be realised. (2) Intention orientation: Different kinds of intentions, visions, goals and paradigms can be distinguished: (a) the engineering vision, (b) the artificiality vision, (c) the extreme gene technology vision and (d) the harnessing of self-organisation vision (cf. Schmidt 2015). It can be shown that the most relevant definition that makes synthetic biology different and sets it apart from other types of technical systems is the self-organisation vision. (3) Technoscientific core orientation: ProTA aims at a closer examination of the technoscientific core of synthetic biology. It reveals that instabilities constitute the core of synthetic biology, since instabilities enable self-organisation. Given the relevance of instabilities, the inherent limits of self-organisation based technology in construction/design and control/monitoring can be considered from a critical angle. In particular, it becomes clear why it is so difficult to control biosynthetic systems. (4) Shaping and alternative orientation: Insofar as instabilities, forming the core of self-organisation, are hard to control, alternatives can be considered. One general option is to make use of so-called cell-free systems that do not show self-organising features to such an extent.

To summarise, ProTA should be regarded as (a) a methodology and as (b) a reflection framework that can be considered an extension of well-established TA concepts, but not as a replacement for them. David Collingridge's fundamental question, "How can we get the technology we want [...], and how can we avoid technologies which we do not want to have?" (Collingridge 1980, 16) might be reworded as: How can scientists and societal actors shape technoscience in the way we want during the early phases of R&D processes?

References: Page 444

A Combined Approach of Prospective Risk Analysis

Bernd Giese, Sven Jensen, Stefan Koenigstein and Arnim von Gleich

Abstract

The prospective assessment of emerging technologies that are still in the stage of basic research runs the risk of being perceived as a nebulous enterprise, partially relying on insufficiently founded conceptions of future trends. But at least with regard to risk assessment, there are options for substantial information as a basis for precautionary action. Lacking information about the circumstances and goals of the future application, we can at least have a look at the basic qualities and functionalities of the technology itself. Such an analysis has to focus on the qualities that define the hazard potential as well as the technological range in space and time. The latter is connected with the exposure potential of a technology. Without exposure there is no risk. In addition, an early characterization of technological qualities has to be complemented by an analysis of the structural vulnerability of potentially exposed systems, which in many cases are assessable even at an early stage. And if, furthermore, knowledge about the probable technological effects on exposed systems becomes available, the prospective analysis can be extended to an effect-related analysis of vulnerability. This paper presents the principles of a corresponding three-step approach for prospective risk assessment.

Introduction

A number of prospective approaches for the analysis and – later – the assessment of new technologies have been introduced in recent years. Tackling the specific challenges of a prospective assessment of new and emerging fields of science and technology (e.g., in the case of synthetic biology) has already been a topic for some years. Accordingly, a number of approaches for a prospective assessment of technologies have been proposed.[1] Owing to the fact that detailed knowledge about the impact of an emerging technology is not available until later stages, Fleischer et al. (2005) for example suggested establishing a collective road-mapping process of science and society for a deliberate steering of innovation processes. Real-time assessment was introduced by Guston and Sarewitz (2002) to combine social science and policy research with engineering in innovation processes. Coates and Coates (2003) recommended including a large variety of media as well as interactive activities in which stakeholders become self-reflective participants. And finally, Grunwald suggested that a focus on visions (as hybrids between facts and pure fiction) would bear the potential to support an "early involvement of reflective analysis and prospective assessment in new fields of science and technology […]" (Grunwald 2004, 58).

So far, the goal of many approaches to prospective technology assessment (TA) is to establish structures that support deliberation and increased reflexivity by all the participants shaping technological innovation (cp. Kuhlmann 2013, for constructive TA). In the early stages of technological development – meanwhile already during the stage of research – the investigation of visions has become a prominent element of analysis and has been discussed in a lively manner in the literature (cp. Grunwald 2009; Karafyllis 2009; Nordmann 2010). The long-term perspective of sociotechnical developments is – without a doubt – an important field of prospective TA. But a number of scenarios run the risk of focusing on what is far from being technically feasible even in a long-term perspective. Many innovations have shown that technology development is often much slower than was originally expected. In many cases technological complexity is underestimated and progress is considerably overrated. One example of such technologies lagging behind their initial schedule is the often postponed step from experimental studies to a first (but still experimental) reactor for thermonuclear fusion. Original claims and visions in artificial intelligence regarding the use of robotics in private households as well as in genetic engineering and nanotechnology have turned out to be quite ambitious as well. However, irrespective of such far-reaching visions, numerous much 'simpler' applications in these fields are already being used in products and processes (e.g., hot and cold plasma for medical purposes and consumer electronics). And in the case of nanotechnology, we have not yet been confronted with uncontrollably multiplying gray goo. Instead, a number of nanomaterials are already part of consumer products and industrial applications (e.g., nanosilver in textiles and cerium dioxide in fuels) and, given their increasing production volumes, exploration of their fate has to become a task of relevant research.

Compared to the issue of how prospective TA is possible, the question of where prospective TA is essentially necessary is perhaps more important. Our thesis is that prospective TA is easier when the prospective effects of the anticipated innovations are caused more by the technology itself than by the circumstances and intentions of its applications; moreover, prospective TA is most important when we have good reasons to expect long-term (irreversible) and global effects. In this case, the possibilities for correcting interventions when things go wrong are very limited. Finally – if already conceivable – we have to look at the systems that are affected.

To assess the risk of such technologies and innovations we need more information about (1) the technology itself (e.g., physical and chemical properties such as solubility or reactivity) and about (2) the affected socioeconomic or socioecologic systems (e.g., which structures or elements are most sensitive). We face uncertainties that are associated with the hazardous qualities of new processes and products, the exposure potential of a new technology, the identification of the exposed persons or objects, and finally the question about the vulnerability of the exposed entities.

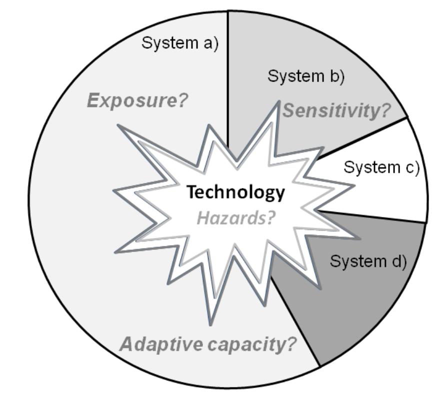


Figure 28: Technology and potentially affected systems

To characterize the hazard and exposure potential we have to analyze (1) the intervening technology and (2) the potentially exposed systems because their properties (e.g., their sensitivity and adaptive capacity) determine the effect of a potentially hazardous technological impact.

By combining an analysis of early indicators for technological impact with an investigation of the vulnerability of the potentially affected systems, this contribution presents a method for the analysis of risk in the early stages of a technological development, which are characterized by great uncertainty regarding the further trends in the innovation process. Within the concept of prospective technology assessment (ProTA) of Liebert and Schmidt (2010), our present early stage-oriented approach serves as a systematic way to analyze "[…] uncertainties and risks, foreseeable impacts and undesired consequences […]" (Liebert and Schmidt 2010, 107).

Elements of this approach to prospective risk analysis will be explained within the following sections.

Characterization of the Technology

It is at least partially possible for a prospective risk analysis to overcome the Collingridge dilemma because central technological qualities such as physicochemical properties and new or improved technological functionalities are already known before we confront new applications. These characteristic features determine the properties of many products and their potential impact. They can even be partially deduced from analogous applications of similar processes or products whose disadvantageous properties are already known (e.g., structure similarities of endocrine disruptors in consumer goods, Roy et al. 2009). Thus, a suitable method should refer to earlier evidence regarding characteristic functionalities which determine exposure and hazards in order to provide orientation for future products (von Gleich et al. 2013). The depth of intervention of technical processes or products (their power to induce effects and/or exposure) seems to be appropriate to serve as a central category for estimating the impact of such functionalities because it corresponds to our lack of knowledge about the potential future impact of a technology due to the long cause-and-effect chains in time and space. In this context, the depth of intervention contains information about (a) technological power as the cause for its hazard potential (e.g., biochemically inert vs. mutagenic or inflammation promoting substances) and (b) its technological range as the cause for its exposure potential (e.g., degradable, nonpersistent vs. persistent or bioaccumulative substances and reproductive entities).

Accordingly, the technological character (C) can be written as:

C= f(depth of intervention [power/hazard potential; exposure/range of effects])

The exposure potential refers to the capabilities of a technology to cause an increased interaction with elements of the affected system, for instance the environment (e.g., due to mobility, persistency and multiplicity).

Besides these inherent qualities of the technology itself – and we could extend the list by characteristics concerning risk management such as failure probability or the possibilities to limit or correct adverse effects – the quantity of an intervention is important as well (e.g., when substances with a long half life or hazardous qualities are emitted). Thus, in an investigation of technological impact, the frequency of an application and the quantities employed have to be derived from early indications of potential future uses.

Results of an initial technological characterization would even be helpful if knowledge of affected systems is not available at the time. However, an early characterization of technologies based on existing evidence for relevant functionalities is only a first step. In many cases a number of potentially affected systems (e.g., types of ecosystems) are also known. Hence, it is advisable to investigate both the intervening technology and the potentially affected systems because the quality of either one influences the extent of potential technological impacts.

Prospective Structural Analysis of Potentially Exposed Systems

In the earliest stages of technological development – the research phase of innovation – an analysis of a system's vulnerability is most probably hampered by the lack of information about the specific events caused by technological interventions. If it is only possible to make a rough estimate of the potential applications and their contexts, an alternative approach in the form of a 'neutral' scan of the potentially affected systemic elements for certain worrisome 'signs' is helpful. These signs should indicate any susceptibility for (a)

long chains of effects and (b) severe and irreversible effects, irrespective of any putative technological intervention. Thus, a structural analysis of vulnerability, regardless of the exposure to any technological impact, would consist of an analysis of the system's susceptibility to stress by collecting information about any vulnerability, such as weak or tipping points. The following questions may help to specify these weaknesses:

a) Are there structural instabilities?

b) Are there instabilities or tipping points due to a nonlinear characteristic in the system's behavior?

c) What is the range of potential effects and, in the worst case, what consequences

might a collapse (due to instabilities or tipping points) have?

Besides vulnerabilities, the system's inherent capacity to overcome potential disturbances should be another matter of investigation. Therefore we also have to ask about compensational abilities:

d) Does the system contain mechanisms for self-repair?

e) How extensive is the adaptive capacity of the system?

In summary, if the potential applications and their contexts are known, a structural analysis of the potentially exposed systems has to include on the one hand a system's susceptibility to stress (its "criticality") and, on the other hand, its capacity to absorb stress.

This adds up to the following term for structural vulnerability (Vs):

Vs = f (criticality, adaptive capacity)

If enough knowledge about potential triggers of unintended effects is already available, a further step of prospective investigation is advisable, namely an effect-related analysis of the affected system's vulnerability.

Effect-Related Analysis of Vulnerability

The third step in our analysis scheme belongs to the established field of risk assessment. According to the definition of risk in an (eco-)toxicological sense, it is subdivided in two parts: exposure and hazard.[2] The first part refers to the extent of a system's exposure to the possible effects of a technological intervention. This effect could be an agent or an impulse. The second part refers to the hazard potential of this effect, which depends on the sensitivity of the affected system. Cause-and-effect chains as in failure mode and effects analysis (FMEA) help to create a model of the specific impact of a technological intervention. But as already mentioned in the previous section on structural analysis, sensitivity has to be analyzed in combination with the corresponding adaptive capacity.

Therefore, in accordance with the IPCC definition of vulnerability (IPCC 2007), a term for the effect-related analysis of vulnerability (Ve) combines exposure, sensitivity, and adaptive capacity:

$$Ve = f\,(\text{exposure, sensitivity, adaptive capacity})$$

Conclusion

In the light of the development of powerful technologies – particularly in the nano-, bio-, and cognosciences and their derivatives – we have to meet the growing demand for prospective technology assessment by identifying the appropriate approaches. These approaches have to be meaningful enough to establish a knowledge base that provides evidence for a precautionary design and governance of (just) emerging technologies even if substantial information – for instance on future applications and their contexts – is missing.

To this end we propose a combination of (1) technology characterization, (2) structural analysis of the vulnerability of potentially affected systems and, with ongoing experience, (3) an effect-related investigation of the vulnerability of affected systems. Regardless of any detailed knowledge about the mode of action of potentially hazardous effects, the results of merely the first two analytical steps (a and b) could be, on the one hand, that a technology would be:

- Improved by a lower depth of intervention or a higher degree of resilience to consequences of failure,
- Contained or,
- Replaced by another solution.

On the other hand, the potentially affected systems could become the object of precautionary intervention to protect highly vulnerable systems or – if practically and economically achievable – to improve the affected system by establishing a higher level of resilience (e.g., the robust condition of immune and ecosystems or by implementing a fire wall).

References: Page 446

Problematizing New Technology

Making Sense of Synthetic Biology

Helge Torgersen and Alexander Bogner

Abstract

In public discourse, any new technology triggers questions such as: What is it for, and what is it like? Is it dangerous, morally acceptable, or simply fascinating? With synthetic biology, different views have emerged with regard to which existing technology it should be compared with, how to discuss it and, hence, how to adequately assess benefits and risks. These interpretations suggest there are different dominant perspectives, like economic benefits, risk or ethics, supplemented by a more aesthetic 'gadget' view. We propose to call these perspectives 'problematizations'. They determine how the new technology is viewed, what is perceived to be the problem and the advantage of it, how to adequately deal with it and whom to involve in its governance. Problematizations render an issue debatable; they are constitutive for any debate and therefore cannot be avoided. This has implications especially for organising participatory TA events.

How to Deal with an Emerging Technology

Whenever a new technology enters the arena of public discourse, a number of questions arise, such as: what is it like? Is it in the stage of a technoscience, i.e. implementing a scientific principle with hindsight to an application, or does it already deliver useful products? How can we make sense of all the claims scientists and technology developers make? What established technology can it be compared with? If it provides realistic options, what do we get, and what would we have to pay in return? In other words, is it useful or fascinating, risky or morally questionable? An important question is what the arguments are that can be considered adequate and legitimate in discussing this new technology. Is risk a major legitimate concern? Are there ethical or moral issues that need to be debated? Or should we predominantly talk about possible economic benefits? Finally, how should this new technology be dealt with? Should only experts decide, or should also stakeholders or even lay people, ordinary citizens, have a say? And what are the options for governance? Do we need new laws, or can we make with the existing ones? Are there other means to come to terms with new issues pending?

A good example for such a new technology is synthetic biology. Introduced as “the design and construction of biological parts, devices and systems” and “the redesign of existing, natural biological systems for useful purposes” (see the SB community website http://syntheticbiology.org), it seems to incorporate different properties from a variety of other more established technologies. This raises the question of which technology it should be best compared with. Is it like biotechnology, just a bit more advanced or, as a major critical NGO put it, is it a kind of ‘extreme genetic engineering’ (ETC Group 2007)? Or emphasising the engineering aspect, is it more like nanotechnology, only that the material to be engineered consists of the molecules of life? Or is it entirely different, namely more like information technology since DNA can be considered an information carrier and tinkering with it an information technology, only that it uses base pairs instead of electrons (Adrianantoandro et al. 2006)?

Hence, we see that under different comparator technologies, the image of SB changes, both benefits and problems appearing in a different light (Dragojlovic/Einsiedel 2013). Accordingly, when debating SB, different aspects emerge as relevant issues to be addressed, respectively. We call them different problematizations, i.e. implicit agreements over what is at stake and what needs to be discussed (Bogner/Torgersen 2014). A dominant problematization enables participants in a debate to argue on a common ground. In this understanding, to problematize means to identify and confine the problems to be taken notice of, to provide the basic terms for the debate, to select the arguments deemed relevant and legitimate, to determine how, and on what grounds, a technology should get endorsed or rejected and, finally, to determine which expertise should be considered relevant.

The Concept of Problematization: Risk and Ethics

The term ‘problematization’ indicates that something emerges and comes to the mind as a phenomenon that is linked to particular problems. These problems determine the particular perspective under which the phenomenon is debated, suggesting which expertise is needed to address the problems, what arguments are relevant and which solutions seem adequate. The concept draws upon two sources, namely problematization in the works of Foucault and Callon, and the framing literature in STS and media research.

Michel Foucault, in his late California lectures, defined problematization as explicitly addressing something that so far has not been perceived as coherent and definite, emerging from practices, habits or conventions and successively conveyed by institutions, rules and authoritative texts (Foucault 1983). Michel Callon, applying a similar concept, emphasises the element of intention: accordingly, a problematization denotes a specific problem configuration introduced by powerful actors (Callon 1986). It imposes solutions that follow the intentions of these actors and serve their interests. The question of intentionality is important; however, we will put it aside for the moment.

Media research has come up with the concept of ‘frames’ to denote different ways of depicting issues in public communication. As Urs Dahinden (2006) has shown, they can be traced back to several basic frames (such as risk or ethics), most of which have a counterpart in problematizations as found in debates on technologies. However, media frames follow the media logic, i.e. they address how the readers’ attention is being raised. They include frames indicating personalization and carry positive or negative connotations. In contrast, problematizations refer to policy issues and are neutral: under a particular problematization, both pro and con arguments can be brought forward.

In past technology debates two main problematizations can be identified: risk and ethics. A third one, economy, is mostly considered the default way of addressing technology and got problematized more recently (e.g. with intellectual property rights). The following table shows some differences between addressing an issue under ‘risk’ or ‘ethics’:

	Risk	Ethics
Subject of dispute	Correct knowledge	Moral imperative
Key question	What is the risk of intervening in natural processes?	Where are the limits to technology? what kind of knowledge do we want?
Basic distinction	True or false	Good or bad
Technologies under the respective frame	Nuclear energy, GM food, nanotechnology (initially)	Animal cloning, stem cells, genetic diagnosis

Table 24: Differences between addressing an issue under ‘risk’ or ‘ethics’

The implications of discussing a technology under a particular problematization are severe: depending on the dominant perspective, different issues become prominent that not only influence the debate but also its potential outcomes. In particular, policy advice, (lay) participation and the legitimisation of decision-making may operate under entirely different conditions subject to the respective dominant problematization. For example, the expertise deemed relevant for risk issues is that of natural science, while expertise may be derived from a variety of sources in the case of ethical issues. This has implications not only for the process of giving advice but also for its legitimisation and the feasibility of non-expert participation. The following table provides a concise overview over some of the differences. Although idealised (with categories sometimes blurred), it highlights different rationales in three respects: policy advice, i.e. the operation to produce input for policy makers; participation, i.e. the incorporation of non-expert views and interests; and legitimisation, i.e. the justification of deliberation processes and decisions. The basic difference between risk and ethics governance is that factual knowledge and personal values are in the driving seat, respectively, which entails a number of other distinctions.

Obviously, the concept of problematization can shed light on how and why various technologies are debated differently as well as on different options for their governance (for a more elaborate description see Bogner/Torgersen 2014).

Implications for	Risk governance	Ethics governance
Policy advice		
relevant expertise	natural sciences	natural/social sciences, religion humanities, lay knowledge
institutionalisation	risk research / agencies	
assessment panels	ethics committees	
relevant input	research	deliberation
expertise expected	objective	balanced
Participation		
articulation	protest	participatory events in a highly artificial, 'laboratory' atmosphere
mobilisation	autonomous (bottom-up)	expert-triggered (top-down)
suitability for participation	low	high
potential impact	considerable	weak
Legitimisation		
reference	expert knowledge	Personal conscience and values of experts and decision makers
basic right	bodily integrity	
intact environment	freedom of belief (various)	
role of expertise	determining facts	advising alternatives
political decisions	bound by external expertise	subject to individual conscience

Table 25: Overview of differences

Problematizing Synthetic Biology

If we apply this concept to synthetic biology, we see risk and ethics as prominent problematizations, but also economic considerations (in particular competitiveness and intellectual property rights). In addition, we see different technologies that SB is frequently compared to, such as GM in case of highlighting risks (de Lorenzo 2010), stem cell research with a focus on ethics and nanotechnology and information technology from an economic perspective. We can also identify a new problematization, namely a 'coolness' factor shaped along the image of information technologies and robotics, implying a hands-on and do-it-yourself community (Delfanti 2013). Which problematization becomes the dominant one is not the least a question of the comparator technology chosen to explain the apparent 'essence' of SB.

The choice of the comparator thus has profound implications on the way SB is discussed. Each suggests a different perspective derived from previous debates on the respective technology. For example with biotechnology, the focus on conflict is prominent, and the debate on SB acquires the leitmotif of preventing such conflicts: what happened to biotechnology – exaggerated risk debates, denial of benefits, endless and futile expert disputes etc. – 'must never happen again'. The public, from this perspective, appears as an object to be mobilised and/or demobilised, depending on the respective stakeholders' interests.

Main problematization	Main perspectives	Main comparator
risk	accidentsdeliberate misuse	GM crops/food
ethics	'playing God'	stem cell research, cloning
economy	industrial applicability, open source	nanotechnology, information technology
"coolness"	play, design, hands-on	information technology

Table 26: Problematizing Synthetic Biology

The choice of the comparator thus has profound implications on the way SB is discussed. Each suggests a different perspective derived from previous debates on the respective technology. For example with biotechnology, the focus on conflict is prominent, and the debate on SB acquires the leitmotif of preventing such conflicts: what happened to biotechnology – exaggerated risk debates, denial of benefits, endless and futile expert disputes etc. – 'must never happen again'. The public, from this perspective, appears as an object to be mobilised and/or demobilised, depending on the respective stakeholders' interests.

With nanotechnology, an important leitmotif of more recent debates was that of 'responsible' research and innovation (Douglas/Stemerding 2013). Nanotechnology was the first novel technology debated under this framework, implying for example upstream engagement, the acknowledgement that trust cannot be taken for granted, that benefits exceeding risks need to be demonstrated, etc. The public appeared as stakeholders to be both educated and involved early in the development of the technology and its applications (Kurath/Gisler 2009).

With information technology, the aspect of pervasive engineering comes to the fore. It implies a role in almost all aspects of the daily life, delivering not only economic benefits but also a plethora of joyful gadgets. At the same time, it includes the notion of maverick technology development (in the proverbial 'garage'), a do-it-yourself movement and a rejection of stringent intellectual property rights (that are constitutive in biotechnology). The public is seen as a fascinated actor, playing hands-on as well as heavily consuming useful (and not so useful) products to come as long as they are 'cool'.

Each of these perspectives entails different suggestions for coming to terms with the new technology. Under a risk perspective, for example, the question is whether we need new laws to prevent unforeseen hazards, not the least from deliberate misuse. Under an ethics perspective, prominent scientists brought up the question of 'playing God' (seeing themselves in that role), raising the issue of how to prevent undue hubris (see Evans 2002). And the engineering 'gadget' character of the new technology prominently materialized in the IGEM worldwide students' competition (Vilanova/Porcar 2014). Via the pronounced engineering perspective, this yearly event also highlights economic aspects of innovation besides the purely 'fun' oriented joy of tinkering with genes and living matter.

The reference to existing comparator technologies serves to suggest a particular dominant perspective. It may be considered an act of deliberately framing the debate, and the question is whether this is possible or avoidable. In other words, is Michel Callon (see below) right in understanding problematizations as imposed perspectives intentionally serving powerful actors' interests?

Depicting SB as 'extreme genetic engineering' (as the ETC Group, a technology-critical NGO did) surely serves to introduce a particular framing, suggesting risk and seeking the link to past biotechnology debates. Likewise, when Craig Venter claimed that he 'does not play' God, it may be understood as an egomaniac self-advertisement sure to cause headlines. And the reference to information technology by the promoters of the prominent 'biobrick' faction in SB may have served to underpin claims for a great future of the field, highlighting the difference to traditional genetic engineering and its shortcomings (including the lack of public esteem). Hence, problematizations may easily be instrumentalized to serve particular actors' obvious interests.

However, to problematize an issue also means to render it debatable. Vice versa, without any problematization this issue cannot be debated because it would be unclear what the problems were, which arguments would be deemed relevant and what kind of expertise would be needed to bring light into the issue. In other words, it would remain a black box, not amenable to any form of public discourse. Avoiding problematizations, therefore, would not constitute a viable option, and comparators in the form of known technologies need to be chosen to better explain what those perspectives are.

However, this has its obvious costs. Raising speculative analogies to past technology debates throw up questions like: will future technologies be discussed in a manner similar to past ones? After all, past technologies may only superficially be comparable to the new one, so a certain problematization might lead to a frame mismatch and to a 'wrong' debate. This raises the question whether there is such thing as a 'right' and a 'wrong' way to discuss a technology, and whether certain problematizations can prevent a 'wrong' or even 'harmful' debate, as policy makers often seem to demand from organisers of a public debate.

Furthermore, if we acknowledge that problematizations are necessary for a debate to be held, who determines which problematization becomes dominant? This is especially relevant for those whose explicit aim is to foster a public debate, i.e. those organising upstream engagement and participatory technology assessment events. Although they might strive not to determine such a debate, non-framing would appear impossible. Should this be taken into account, or even made a constitutive element of participatory TA in a pro-active way? Would this foster or reconcile pending controversies?

We propose that such considerations be actively addressed when planning and conducting a participatory event. Finding suitable problematizations and comparators appears mandatory for conducting any fruitful debate. While choosing problematizations, organisers should not fear a controversy because that is what makes a debate lively: technology controversies are nothing to be avoided but an important element of an enlightened way to publicly come to terms with technoscientific novelties.

References: Page 447

Nano Risk Governance

Extending the Limits of Regulatory Approaches through Expert Dialogues

André Gazsó and Daniela Fuchs

Abstract

New technologies such as nanotechnologies involve new materials and products, e.g., in medicine, cosmetics, optics, or construction, but safety and governance issues have not been an equal object of systematic investigation. The NanoTrust project was therefore established to collect the knowledge available on safety and regulatory issues and to analyze it. Furthermore, the communication of this knowledge to the public as well as to decision-makers has been part of the project form the beginning, thus helping it to organize an exchange of knowledge and to contribute to qualified political decision making. This paper sketches the development and modification of the NanoTrust project as part of the Austrian nano governance system since its inception in 2007.

Introduction

Shortly after the Austrian nanotechnology research program ('Nano Initiative', NI) had started in 2003, the organizations that were involved considered some kind of accompanying technology assessment (TA) necessary. Three years later, the fully fledged TA project NanoTrust came into life. The motivations for its establishment differed: TA institutions wanted to become engaged in a then new field, while organizations funding and managing the NI had in mind 'not to run into the same public communication disaster like with gene technology'. Thus, their main reason for dealing with risk and safety issues was to prepare for a future public debate. Subsequently, the Health and Environment ministries appeared, asking for safety relevant data as a basis for regulatory decisions. As a consequence, NanoTrust has been cofunded by several ministries for a decade (until 2016 at least). It is carried out at the Institute of Technology Assessment of the Austrian Academy of Sciences as a classic research project. But it was clear from the onset that this research project will have a high share of consultancy requiring a rather high need for communication.

Development of the Project

According to the logic of the project, the previous evolution of NanoTrust can be divided into four phases, beginning with the first contacts to the management of the Austrian Nanotechnology

Initiative (NI). After a preparatory phase starting in 2003 to create a certain awareness for nanosafety topics, the NanoTrust project was started in 2007 as a consequence of the need to have a profound research activity on nano risk governance issues. During this first period (2007-2010) the main network for developing the Austrian nanotechnology action plan was established. The next NanoTrust period (up to 2013) was devoted to introducing the internal and external communication instruments (e.g., NanoTrust dossiers). Since 2013 NanoTrust 3 has been part of a more formal nano governance system, whose functions include holding the chair of the Austrian Nano Information Commission, which is part of the Austrian Ministry of Health.

Phase 1 (2003 – 2006): Preparation

In spring 2003, the Institute of Risk Research (IRR) of the University of Vienna decided to approach the NI management to establish an additional line of research for TA and other projects regarding risk and safety issues. The intention was to provide as much space as possible for research accompanying the three existing R&D oriented program lines. The answer of the NI management came immediately and was strongly in favor of this suggestion. Nevertheless, it took nearly three more years to place the first safety-relevant projects. A separate line of research as part of NI has never been established. In the summer term of 2006 a lecture series was held at the University of Vienna which was financed by one of the NI program lines (called "public measures"). This lecture series dealt with several questions of public interest ranging from consumer health and safety to ethical considerations. This event was eventually published in a book (Gazsó et al 2007). In the same year The Institute of Technology Assessment, meanwhile cooperating with the IRR, was asked by the Austrian Ministry of Traffic, Innovation and Technology (BMVIT) to prepare a status report on the situation of the international environmental, health and safety (EHS) and ethical, legal and societal implications (ELSI) of research regarding the use of nanotechnologies and nanomaterials. This report, published in 2006 (ITA 2006), was written in cooperation with IRR and Idialog, a private research group based in Vienna. This is strong indicator that at this time safety relevant issues had become relevant to public authorities.

Phase 2 (2007 – 2010): NanoTrust, a new face in the regulatory crowd

After intensive negotiations between the ITA and the Ministry (BMVIT), a rather wide-ranging and comparatively well-equipped project was launched in October 2007. This interdisciplinary research project consisted of three full time researchers coming from three different educational backgrounds (technology assessment, risk research and cell biology). A strong reliance on scientific expertise was meant to secure a strong linkage to mainstream research. The original idea was to serve as an interpreter of scientific findings – provided that they are concerned with safety issues – for all sorts of recipients (e.g., scientists, science journalists, public authorities, and the interested public). The foremost task was to identify research and regulatory deficits and to provide reliable information on safety and risk-relevant topics. In this first phase the main contacts were established, especially towards safety research institutes and regulatory bodies, and mainly in the fields of consumer safety and worker protection. The communication strategy was also set up within the first six months, involving the members of the scientific advisory board. Defining the specific tasks of the projects has always been the autonomous responsibility of the ITA. This sovereignty with regard of content and procedure has never been questioned by any governance

stakeholder, especially not by the BMVIT, but it has proven to be a wise decision to inform all the concerned parties right from the onset about the goals and the scope of work of NanoTrust. By the end of the first year NanoTrust was both accepted as provider of reliable and balanced information (in the form of so called NanoTrust-Dossiers and several public events) and as a productive supporter of the main governance activities going on in Austria, such as the Austrian Action Plan Nanotechnology (ÖNAP) (Jakl et al. 2009).

Phase 3 (2007 – 2013): – NanoTrust 2

In October 2007, the project NanoTrust was extended for another three years without any greater modifications. As a result of the project performance during the previous three years, some continuity was established regarding both the specific products of NanoTrust (dossiers, annual conference), and its status as a contributor to governance bodies such as the action plan, the nano platform and eventually the nano information platform.

Phase 4 (2013 – 2016): NanoTrust 3

NanoTrust was extended once more in October, 2013, following intensive negotiations at the beginning of the year. The working plan for an additional phase was presented at a common meeting involving all the concerned ministries in February, 2013, and once more at the annual meeting of the project board in June, 2013. In this phase, NanoTrust had to undergo major modifications regarding the composition (project members), mainly because of the departure of one researcher who moved to a different research institute. The following restructuring phase led to a stronger focus on TA and risk governance matters (which go well with the institute's research program) and did not affect the previous project tasks, neither the project products nor the communication strategy. Concerning these developments, it should be mentioned that NanoTrust had been especially involved in the development of the Austrian nano risk governance landscape by taking part in the preparation of the rules of procedure of the nano information commission (NIK) of the Ministry of Health and, eventually, by being assigned the chair of this commission.

Austrian Nano Risk Governance: The Role of NanoTrust

Austrian Nano Action Plan (ÖNAP)

The Austrian Nanotechnology Action Plan (ÖNAP) was published at the end of 2009 by the Austrian Ministry of Environment (BMLFUW) in cooperation with several other federal ministries and authorities (science - BMWF, technology and innovation - BMVIT, social affairs including worker protection - BMASK, and health - BMG) and with the participation of several other institutions, such as the Austrian Environmental Agency, the Chambers of Commerce (WKO) and Labor (AK), and the Austrian Food Safety Agency (AGES). Additionally, a large group of scientific institutions (University of Vienna, University of Agriculture, Austrian Academy of Sciences, and others took part in the final preparation of the Action Plan. Environmental NGOs and other public interest groups were also invited to contribute but reacted rather reluctantly. The work on the ÖNAP started in autumn 2008 as a direct consequence of the rather informal discussions started in the Nanotechnology Network established by the BMLFUW. The activities were organized in four working groups coordinated by the BMLFUW. The NanoTrust project participated in all four working groups and has been a strong supporter of this endeavor from the onset. A seminal contribution by the ITA was a presentation of the main contents of international nanotechnology action plans to the members of the BMLFUW nanotechnology platform in April 2008.

The ÖNAP was eventually adopted by the Austrian Council of Ministries in March, 2010. Altogether, the consensus-based ÖNAP contains fifty recommendations in the fields of environment, health and occupational safety. Fundamental to these recommendations is the demand for (public) dialogues and transparency among all stakeholders including the breaking down of scientific knowledge into generally understandable language. The central recommendations comprised (a) the creation of a public information web portal, (b) the establishment of an independent nano-EHS-research program at the national level, (c) the development of detailed worker safety guidelines for Austrian work places, taking the specific Austrian company landscape into consideration, and (d) the prolongation of NanoTrust.

NanoInformation Platform (NIP)

The purpose of the foundation of the Nanotechnology Information Platform (NIP) was to bring together experts from a wide variety of fields including NanoTrust. NanoTrust has taken part in this specific breakout group since its very beginning in April 2010. The first contribution of NanoTrust consisted in a draft of the possible contents and processes of such an information portal, which was discussed during the subsequent monthly meetings.

The result of these expert discussions was the establishment of a website nano-information portal (nanoinformation.at), hosted by the BMG, which went online at the end of November, 2012. It ensures a continuous information flow between experts and the (interested) public and gives people the option to interact with regulatory authorities and experts in case there are questions and concerns. It is one concrete outcome of the ÖNAP. The nano-information portal is a common project of all the concerned ministries (health, environment, technology, science, and social affairs, as well as a group of scientific and public groups).

Material for this public information platform is developed in different self-organized working groups. The draft documents meant to be published on this website have to be adopted by all the members of the NIP and are then edited by an editorial team consisting of AGES and BMG. The writing of articles in the nine different categories (basics, products, food, health, environment, occupation, science and research, law, and the Austrian Nanotechnology Action Plan) is organized differently, but a review process is conducted before publication on the website to make sure that all aspects of a certain topic are covered. NanoTrust provides documents (or specific content for documents) in several categories, such as worker safety, consumer protection, science and research, and regulatory issues. A formal working group on worker safety was established in June, 2011, under the responsibility of the Austrian Worker Compensation Board (AUVA), the biggest insurance company for work places in Austria (2.3 million insured people). NanoTrust has been part of this working group since its beginning and regularly takes part in its meetings.

Austrian Nano Information Commission

The Austrian Nano Information Commission (NIK), which belongs to the Austrian Ministry of Health, was founded in September, 2013. According to its rules of procedure (paragraph 2), the NIK is defined as an advisory body for the respective member of the federal government responsible for the protection of consumer's health concerning the societally relevant aspects of nanotechnology. The NIK is concerned with public communication and represents the diversity of opinions and the professionally sound state-of-knowledge of various scientific experts. Proposals for new members can be made by the plenum. ITA designates one full membership and a substitute to the NIK. The chair is hosted for 5 years and currently held by André Gazsó (until 2018). The main task of this commission, which meets three times a year, is to (1) provide all members with information on the current research and developments in the field of nanotechnology safety, to (2) offer an opportunity to discuss and evaluate these findings an (3) to foster safety-relevant research concerning the use of nanomaterials in Austria.

Conclusions

The NanoTrust project shows several distinctive features that may be indicative for TA's role in assessing emerging technologies.

Originally, the project was intended to 'investigate risk and safety relevant issues regarding the use of nanotechnologies'. However, risk analysis and evaluation rules require that system limits be properly set in order to ensure the validity of results. For nanotechnologies, the necessary focus on a very early phase of development entails extending the system limits far into the future, blurring statements on development paths to a greater or lesser degree. As a consequence, uncertainties emerge rather than risks.

The main project aim was to create robust and regulatory relevant knowledge. The high level of uncertainty, however, required that the process of knowledge creation was mostly organized in the form of transdisciplinary expert dialogues. As a consequence, NanoTrust indulged in a variety of expert networks and risk assessment committees (e.g., Austrian Nanotechnology Action Plan, Nanoinformation Commission) right from the beginning. These developments were extensively presented and discussed in a recent publication (Gazsó & Haslinger 2014).

This created another problem for TA. As the project developed into its being a part of the regulatory system, it was no longer possible to remain in the role of an observer. TA not only provided reliable information and evaluated risk and safety relevant knowledge. Its role grew to also include the task of initiating joint activities, coordinating and eliciting discussions, and even suggesting aims and visions to be shared among partners in order to jointly organize the generation of new knowledge.

These activities can only be credibly performed if the TA researchers' roles within such networks are unambiguous and are openly communicated to the partners. Therefore, the role of the NanoTrust project members had to be carefully reflected. Eventually, the decision was taken to adopt a role Roger Pielke would call an 'honest broker of knowledge' (Pielke 2007).

References: Page 447

INTERDISCIPLINARITY IN TECHNOLOGY ASSESSMENT

Articles from the PACITA 2015 Conference Sessions:

(10) Integrated Approaches in Technology Assessment
(17) The Importance of Strong Science Journalism in Technology Assessment
(23) Interactive BIO FICTION Film Lounge
(26) Visions of Technology Assessment – A Panel Discussion with Kick-off Statements
(30) Varieties of Technology Governance and Opportunities for Technology Assessment

Interdisciplinary Integration in Technology Assessment

A Report from Practise

Stephan Lingner

Abstract

Technology assessment (TA) aims naturally at questions of societal relevance, which are often complex, ambivalent and prone to uncertainty. These factors, together with the task of determining the necessary levels of abstraction, constitute the specific framework conditions for conducting the task of technology assessment. The complexity of TA questions addresses quite different relevant disciplines which have to be properly represented within these frameworks, not only in an additive manner but also by reflexive approaches which allow for deliberation on the apparent and hidden facets of the same subject from different disciplinary and methodological perspectives. Creating the corresponding frameworks for reflection on technology is expected to reduce any disciplinary or methodological biases of assessments, thus levelling individual or discipline-dependent subjectivities to some extent. The paper explores a rather simple but effective integrative TA approach, which is however limited to certain assessment domains.

Introduction

The task of assessing modern technologies and their prospects for and impact on the environment and society has to face the challenge of dealing with (a) complex systems, (b) the uncertainty of related processes and (c) the ambivalence of interpretations with regard to the addressed cognitive and normative levels. These requirements apply to a landscape of historically grown scientific disciplines, which reflect more past cognitive and societal interests rather than those of the near future. Prospective technology assessment (TA) therefore requires the relevant topical and methodological knowledge or skills, which often transgress the borders of long-established scientific disciplines.

The following example will illustrate this idea: The County of Copenhagen had to face a severe consultants' dilemma in the year 2000 (for details see Refsgaard et al. 2006), when it commissioned several independent prospective studies on the environmental fate of a certain catchment area. It was then badly surprised by quite different spatial vulnerability patterns given by the respective assessments (see Figure 29). The assumption that poor science might have been involved is not likely here because exclusively renowned consultants participated in the assessments and used the same set of raw data. A meta-analysis by Refsgaard et al. (2006) showed that the five consultants introduced quite different disciplinary perspectives and methodological means into their assessments. These specific angles for judging the same situation led to (a) diverse interpretations of the raw data, (b) unique attributions of causal factors and (c) various processes modelled in the respective analyses as well as (d) distinct presuppositions of the specific problems at stake. Under these circumstances it seems hardly surprising that the size and distribution of potential hotspots in the investigated area differed substantially.

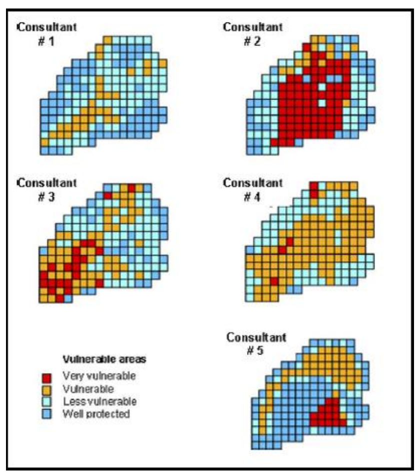


Figure 29: Different environmental assessments of spatial vulnerabilities near Copenhagen Airport
(adopted from Refsgaard et al. 2006)

So generally spoken, any monodisciplinary assessment can only claim for validity within its own disciplinary and methodological "canon" while disclosing any relevant presuppositions at the same time. This finding seems to be trivial but the practice in advisory contexts shows that the awareness of structural uncertainties from different approaches to assessoften "disappears" in the course of consultations (Kaiser 2014), thus leading to biases in the comprehension and communication of these assessments. Moreover, the conflicting results from competing assessments, like those illustrated in Figure 29, will most probably lead to confusion among actors, given the fact that no meta-analysis will assist them in formulating sound choices from differing appraisals.

The adequate orientation of those actors, who are in charge of technology and innovation governance, will thus necessarily need interdisciplinary perspectives of the respective problems at stake. However, broadening perspectives would (and should) not require

scientific assessments to be "de-disciplinised". Establishing appropriate multi-disciplinary frameworks could instead make it possible to reach comprehensive perspectives on complex issues under pressure of practise. The constitution and organisation of these corresponding frameworks has to ensure that the participating disciplines are not simply added to each other but that they are tightly integrated in a joint epistemic effort. Effective integration is therefore a prerequisite for coming up with interdisciplinarily valid conclusions, which avoid the above-mentioned shortcomings of structural uncertainty and, finally, the unnecessary and undesired confusion of the addressees.

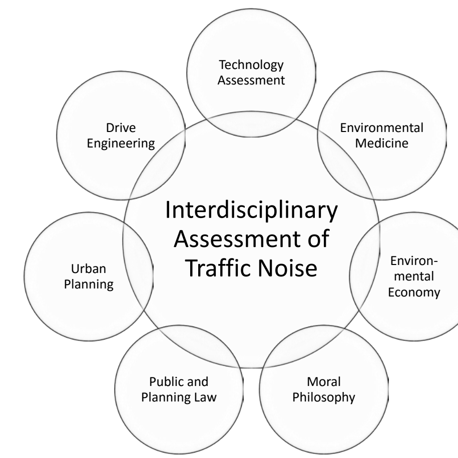


Figure 30: Framework of an experts' traffic noise assessment

An Interdisciplinary Team Approach

This section briefly describes an integrated team approach, which has been successfully tried and tested within 25 interdisciplinary projects at the European Academy (EA) over the last two decades . The topics investigated so far cover a broad spectrum of technology issues, ranging from strategies for climate protection and for balancing renewable energy to evaluative studies on synthetic biology to standards development for human brain intervention. The applied assessment method is rather simple and gathers the competence of those individuals who are well-recognised experts in the problem-specific fields or disciplines. Experts, in this notion, are scientific researchers as well as practitioners with the relevant contextual knowledge. So far, they have been recruited from Europe or abroad, depending upon the definition of the tasks and the accessible networks. The experts' role is to engage in organised discourses and assessments on challenges posed by specific technologies while becoming associates of EA at least over the life-time of the respective project. Figure 30 illustrates an example from a completed interdisciplinary assessment of mobility, noise and its regulation at EA. The project was coordinated by a staff member of the academy who had professional affinity to the topic and who offered his or her TA experience for the project. Several external experts from engineering, medicine, spatial planning, ethics, economy and jurisprudence joined the project after being invited and cooperated within this framework while preparing a comprehensive and evaluative study of the problem at stake, which was finally published (Kloepfer et al. 2006) . The equal standing of the assembled experts and their recognition of each-others' competence enabled the establishment of a framework with "multilateral epistemic dependence", which can be seen as a prerequisite for effective interdisciplinary integration (see Andersen/Wagenknecht 2013).

Within the subject-specific needs of this or similar EA projects, the experts nominated so far have usually proved to be capable to represent their broader discipline, even beyond their subdisciplinary specialisations. In certain cases, they recommended further specialists to add their expertise to the project either through targeted papers or by joining the project group. Generally, each project group covers the relevant descriptive and normative sciences, thus being capable to come up with sound and legitimate conclusions. However, organised interdisciplinary discourses are also social endeavours: Tight and enduring collaborations face-to-face within joint projects on a voluntary basis require critical masses of individual motivation, resources, ability and social skills, which cannot be taken for granted for the candidates for an interdisciplinary working group. The appropriate selection of high-level and socially competent professionals is therefore a crucial determinant for the successful collaboration of the study team in spe. Main selection criteria are therefore scientific record and interdisciplinary experience. Incentives to cooperate beyond one's respective institutional commitments range from (a) organisational support by the coordinating institution, to (b) allowances paid to project members for extra efforts, to (c) the reputation from being a member of an academy's project and of an international network of renowned experts. The academy's interdisciplinary procedure can be described by the following workflow (Figure 31), which has been continuously aligned and improved according to the practical experience from its precursor projects.

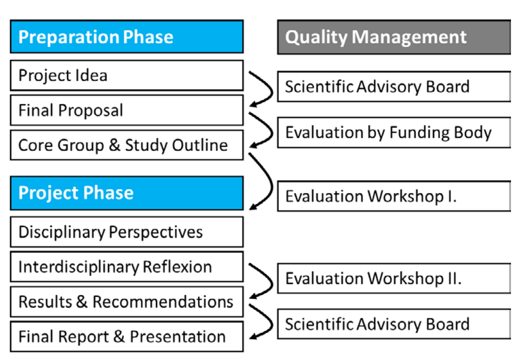


Figure 31: Workflow of a project for an interdisciplinary experts' assessment (modified from Decker & Grunwald 2001)

The project workflow follows typical steps, which are accompanied by different quality-enhancing measures over a lifetime of usually two to three years (cf. Decker/Grunwald 2001). In the preparatory phase, the project coordinator creates the project idea, which takes up current concerns of the public and funders with regard to our sociotechnological future (e.g. on worries about alien species created by synthetic biology). The idea will be specified towards a detailed programme of work and a provisional study outline by including recommendations from advisory bodies and funders as well as input from a core group of experts at the academy, which has to be established in parallel. An early evaluation workshop with other researchers and prospective addressees will review the programme and make suggestions for adding any further necessary competence. After the corresponding consolidation of the working group's members, the project's main phase usually starts with a stocktaking of the problem issue from different disciplinary perspectives. Corresponding raw papers are naturally still incoherent at this point. Several iterations of these papers will be then critically discussed and considered by the whole interdisciplinary study group with the aim of coming up with a common aggregated, consistent and well-integrated analysis. This step is crucial for claiming extended interdisciplinarity[1] but rather challenging and thus time-consuming because distinct disciplinary subject foci, notional meanings, theoretical backgrounds and methodological traditions have to be aligned to some extent in this joint exercise. The multidisciplinary description of the problem issue and its interdisciplinary assessment will also undergo an external evaluation with the aim of identifying any blind spots or biases in the draft appraisal. Having considered the commentaries, the project group is finally able to formulate well-founded conclusions or suggestions for the addressees of the study (e.g. strategies against invasive species in case of synthetic biology applications). After notification of advisory or funding bodies of the draft, the final report of the study team will be published and presented to the broader public.

Limitations of Competence and Advisory Domains

The approach described above is based on the expert principle and therefore strictly knowledge-based. It claims rationality from an epistemic point of view but might be challenged by concerns over legitimacy, especially with regard to any expectations of a broader integration of public voices in the assessments. These expectations have to be dampened to some extent for the following reasons. Broad public participation does not necessarily enhance legitimisation. Court hearings might illustrate why public participation in judgements are sometimes not desirable. Being directly affected by concrete decisions on large technological infrastructures is, in contrast, a good argument for public participation. However, the above described interdisciplinary framework is aimed more at general and fundamental questions of technology options and governance and not at direct support for decision making. It develops coherent principles and guidelines of acting in a "wicked" world and thus at general statements or robust strategies, not at actual (and sometimes even volatile) acceptance of specific choices. The latter point is crucial, as the prospective view of this TA approach often has to face long-term issues and thus also the affairs of future generations, which for obvious reasons cannot themselves be present . Therefore, some paternalism is inevitably connected with the long-term perspective of this approach or of those other TA frameworks which also aspire to long-term responsibility. Under these conditions and limitations it seems legitimate to draw even normative conclusions from experts' frameworks.

The interdisciplinary team approach allows, furthermore, reflection on and integration of originally diverging individual beliefs and disciplinary perspectives, in the attempt to reach consistent and consensual assessments. The results claim epistemic reasonability and normative desirability; they can be considered here as valid in a trans-subjective manner. Corresponding robust knowledge might enlarge the conditions for the acceptance of related choices in the context of governance although actual broad acceptance can never be guaranteed. The aim of the science-based academy's approach is finally to improve research and innovation policies. To that end it informs and advises especially the science system itself, which is challenged by its own specific autonomy, self-governance and self-responsibility in the face of its role in society.

Conclusion and Outlook

The expert-oriented TA approach aims primarily at reflecting on and generating problem-relevant knowledge at the interface between science and society. This more general and strategic knowledge might serve as sound basis for the creation of specific attitudes or action plans of the respective stakeholders and decision makers.[2] The strong integrated interdisciplinary design of this TA-framework allows the critical analysis of sociotechnological challenges covering the whole spectrum of scientific to social and policy-related perspectives. It enables the integrative assessment of technological options and their effects, and the investigation of related societal conflicts and of different policies and their underlying objectives. The interdisciplinary assessments conclude with corresponding suggestions and recommendations for the level of action.

Currently, the EA tries to combine its expert approach with more trans-disciplinary frameworks while exploring new advisory domains where necessary and applicable. The appropriate inclusion of stakeholders and lay persons is targeted at the self-reflection of actors and at the activation of public and political debates on technology and innovation in local contexts. Correspondingly informed and reflected knowledge will finally result in new impetus, in rational decisions and in effective innovation at the municipal level. However, it is too early at this point to discuss the still uncertain success of this framework extension. Evidently, critical features of this combined approach are quite similar to those which have recently been explored and assessed within the European project EST. The resulting integrative and trans-domain "TranSTEP"-approach by Thorstensen et al. (2014) might serve here as a primer for relevant methodological efforts of the TA community in the future.

References: Page 447

Problem-Oriented Interdisciplinarity in Technology Assessment

Methodological Reflections

Jan C. Schmidt

Abstract

The aim of this paper is to contribute to a further conceptual clarification and foundation of TA. The objective is to shed some light on the vague notion of "problem" in order to advocate a specific type of interdisciplinarity (ID): problem-oriented interdisciplinarity. Taking an ex negativo approach I will show what problem-oriented ID does not mean. Using references to well-established distinctions in the philosophy of science, I will show three other types of ID that should not be placed under the umbrella term "problem-oriented ID": object-oriented ID (ontology), theory-oriented ID (epistemology), and method-oriented ID (methodology). I will clarify the notion of "problem" by looking at three systematic elements. The paper concludes by stressing that problem-oriented ID that is claimed to be inherent to TA is the most challenging type of ID.

Introduction

In the discourse on TA – as well as on interdisciplinarity – the notion of "problem" plays a key role. According to Decker (2010, 145), TA is in its origin "interdisciplinary" since it "identifies and works on trans-scientific problems" that are "political or societal problems." Thompson Klein et al. (2001) characterize interdisciplinarity by its reference to problems: interdisciplinarity is "joint problem solving among science, technology, and society". In the same vein, Mittelstrass (1998, 44) stresses that "by 'transdisciplinarity' we describe types of research and sciences that transcend disciplinary orientation in a problem-oriented manner." However, is the common parlance about problems self-evident?

The objective of this short paper is to foster and facilitate the theory discourse on TA and interdisciplinarity in TA, in particular providing a conceptual foundation of problem-oriented interdisciplinarity by finding a demarcation line between this type of interdisciplinarity and other types (cp. Schmidt 2011).

Classification and Demarcation

Two assumptions are implicitly most prominent when talking about interdisciplinarity: the *boundary premise* presupposes a dichotomy or, at least, a separation between disciplines or between academia and society; the *transgression premise* assumes that options for overcoming boundaries do exist: transfer, integration, unification, elimination. ID obviously gives rise to a boundary paradox: elimination and conservation of boundaries at the same time. If "elimination" were to succeed, ID would dissolve. Instead of boundary paradox, a more appropriate term would seem to be *boundary dialectic*, which is similar to Hegel's Aufhebung. A twofold requirement for a reflection on ID is a concept of both separation and integration. By considering boundaries, the position of ID integrationists, unificationists, and reductionists can be rejected. The boundary theme is an old topic of philosophy, intrinsically interlaced with monism, dualism, and pluralism, and with reductionism and non-reductionism. Against this background we will now consider four types of ID and thereby draw a distinction between problem-oriented ID and other types. We will employ the well-established distinction between objects (ontology), knowledge/theories (epistemology), and methods (methodology) (cp. Schmidt 2003; Schmidt 2011).

When we speak of "problem-oriented ID" we do not refer to objects and entities as the object-oriented type of ID. However, the latter type of ID is very strong throughout the discourse. The historically established functional differentiation of scientific disciplines does not seem to be totally contingent. Rather, it mirrors aspects of the structure of reality itself. Husserl, Hartmann, Whitehead, and others have favored a structurally layered concept of reality. Boundaries between the micro-, meso-, and macro-cosm seem to be evident. Interdisciplinary objects are thought to be located or constructed within the structure of reality: They lie on the boundaries between different micro-, meso-, macro-, and other cosms or within the border zones between disciplines. Examples are: brain-mind objects, nano objects, or the hole in the ozone layer. In order to advocate this position one has to presuppose an ontological realism, or at least a real-constructivism concerning the objects, interlaced with a layered concept of reality, and, based on this, an ontological nonreductionism. In this context, "ID" refers to an external, human-independent reality; some weaker versions of this position do not claim the timeless ("Platonist") existence of interdisciplinary objects. The future development of science may shift these objects to domains of new disciplines or, on the other hand, it may be shown that they belong to fields of classical, already existing disciplines. Or, one may consider interdisciplinary objects to be created by the extended use of technologies ("real-constructivism") or cognitively constructed by sciences themselves ("cognitive constructivism"), for instance, the hole in the ozone layer, nanobots, or some of the virtual objects which are nowadays the objects of inquiry of the computer sciences (cp. Schmidt 2008). Haraway's hybrids, Latour's quasi-objects, Leigh Star's boundary objects, Baird's things und Nordmann's technoscience ontology can be regarded as real-constructed interdisciplinary objects.

Problem-oriented ID obviously does not refer to theories or concepts; it is not a theory-oriented type of ID. If we want to talk about theory-oriented ID, the pertinent question is, can any particular type of knowledge, recognition or scientific truth be called "interdisciplinary"? Can we demarcate interdisciplinary knowledge from disciplinary knowledge and from non-scientific knowledge? Is there a unique context of justification? Do interdisciplinary models, laws, descriptions, and

explanations exist? Possible candidates for theory-oriented ID are concepts which can be applied to describe different objects in different disciplinary domains; they highlight structural similarities between properties of these objects. Such theories cannot be reduced to disciplinary ones. Theory-oriented ID is, therefore, based on an epistemological non-reductionism. Structural sciences such as complex systems theory are prominent examples. Structurally similar process phenomena – e.g., pattern formation, self-organization, bifurcations, structure breaking, and catastrophes – can be found in different disciplinary branches. The objective is an integration of general structures regardless of the disciplinary content. Alike theories are self-organization theory, dissipative structures, synergetics, chaos theory, and fractal geometry. Haken (1980) regards synergetics as an "interdisciplinary theory of general interactions". Most of these interdisciplinary theories were established in the 1960s and 1970s. Basic ideas – and the term "structural sciences" – however, can be found in works from the 1940s and 1950s. Structural sciences "study their objects regardless of disciplinary domains and in abstraction from disciplinary content" (Weizsäcker 1974, 22). Classic examples are cybernetics, information theory, and game theory.

Moreover, the specification of problem-oriented ID does not so much take into account interdisciplinary methods – even though, arguable, this dimension might play a role. Method-oriented ID refers to knowledge production, to research processes, to rule-based actions, and to languages. The central issue of methodology is how, and by which rule, can and should we obtain knowledge? Do interdisciplinary methods and actions exist? Is there a specific context of discovery within interdisciplinary projects? Interdisciplinary methodologies, however, are thought to be irreducible to a disciplinary methodology. Biomimicry/bionics claims to be an interdisciplinary transfer methodology from biology to engineering sciences. The basic idea of biomimicry is "learning from nature" in order to "inspire technological innovations." Nature seems to provide excellent inventions that can be used to develop efficient technologies. However, the transfer is not a one-way street. Biomimicry constructs models of biological nature based on the perspective of engineering sciences. A robot mimics an ant, but at the same time the ant has been described from the mechanistic perspective of technology. Besides biomimicry, there are other examples of interdisciplinary methodologies. Econophysics methodologically organizes a transfer between physics and finance/economics. In addition to these transfer methodologies, a new kind of non- or meta-disciplinary methodology of knowledge production has emerged over the past 50 years: mathematical modeling and computer-based simulations. Special kinds of integrative methodologies have been developed in the realm of technology assessment (TA), social-ecological research, and transdisciplinary sustainability research. However, the integration methodologies are still an ongoing challenge throughout this field, in particular when the integration of descriptive, normative, and abductive forms of knowledge is involved.

Incommensurability and Dichotomy

It is striking that the three types of ID elaborated above do not cover the whole breadth of the notions of ID that are present throughout recent discourses. We therefore have to add another type that does justice to the discourse. It is frequently stressed that the world has problems and that the academic world has departments and disciplines. It would appear that the world's problems and the academic world, in particular the university system, are incommensurable. The incommensurability thesis is the point of departure of those who advocate another type of ID.

This type of ID focuses on the starting points, goals, and purposes of ID research activities, in other words, on the constitution, identification, and framing of problems. Problems make this ID type necessary and indispensable. Throughout the ID discourse, it seems to be a widespread position that "problem-oriented research has to be interdisciplinary or transdisciplinary in its very core" (Bechmann/Frederichs 1996, 17). Although the reference to challenging, complex real-world problems and the call for ID is popular today, it has its own history. In an epochal-breaking approach, Alvin Weinberg (1972) was the first to suggest the term "problem" in the context of research for society. Weinberg speaks of "big problems", such as challenging and pressing questions of national security, the future of the social welfare system, the science policy of research and development programs, and environmental problems. Weinberg's still-relevant diagnosis was: the science system does not have any answers to pressing societal questions. In order to overcome the deficits Weinberg developed the concept of "transscience".[1]

ID problems are regarded as being external to disciplines or to academia. They are primarily societal ones that are (pre-) defined by society, e.g., lay people, politicians, and stakeholders. This approach to the societally relevant starting point of research activities comes close to today's science-based enterprises such as TA, sustainability science, and global change science, which can be considered as examples of this type of ID. Throughout the discourse on problem-oriented ID, the assumption of boundaries is striking and gives rise to the boundary paradox. A clear demarcation is considered to exist between sciences and society, which is a strong thesis of an internal-external dichotomy. Insofar as problem-oriented ID aims to transgress the border-line, it has to assume that it exists: the boundary is a necessary condition for talking about problem-oriented ID. Problem-oriented ID intends to transgress this boundary in two ways. It takes up external (to science) societal problems, works on them internally, and transfers the results to the societal domain in order to contribute to extra-scientific societal problem-solving.[2]

Problem-oriented ID reflects on and revises the problem perception; the starting points of science and technology programs are at the focus. This is interlaced with problem framing and agenda setting. Because problems precede both the context of discovery and the context of justification – in other words: methods/means and theories/models – problem-oriented ID is a specific type of ID that cannot be subsumed under the label of method-oriented ID or theory-oriented ID. The teleological structure in the process of knowledge production is most evident but not always acknowledged. The first step in scientific inquiry – the problem seeing and agenda setting, the volition or intention to obtain knowledge – is often judged to be a contingent factor. It has been widely ignored or devaluated by the philosophy of science, although extended work has been done on problems called "wicked problems". Discourse ethics, however, developed by Apel and Habermas does not follow the mainstream practice of neglecting the very starting points, including the perception and framing of problems (for example: Habermas 1991). Furthermore, concepts of rationalist TA (pre-projects) (Grunwald 1999), prospective TA (Liebert/Schmidt 2010), and social-ecological research (Becker/Jahn 2006) have addressed the issue of problems as the starting point of any problem-oriented interdisciplinary project. It is interesting to note that in line with this as early as in 1962, Kuhn

perceived a professional blindness of scientists with regard to societal problems: "A paradigm can isolate the scientific community from socially relevant problems that resist being reducible to the form of a puzzle insofar as such problems cannot be expressed in the terminological and instrumental means of the paradigm" (Kuhn 1996, 51). Kuhn adds: "The societally pressing problems, such as finding a therapy against cancer or concepts for a lasting state of peace, are certainly not puzzles."

Problems are also not to be considered puzzles because they do not have clear solutions in a way that scientific puzzles are assumed to have. Problem-oriented ID does not offer solutions in the way that engineering sciences are able to come up with a new artifact to solve a technical problem. Rather, in problem-oriented ID much is achieved when a problem is constituted, framed, and clarified. In other words, when rational arguments underlining the fact that a certain situation is a problem are presented. Problem-oriented ID may offer advice on possible solutions to problems; the science system itself is not legitimized to recommend any kind of solution; otherwise democratic societies would turn into expertocracies.

Clarification

According to Pohl and Hirsch-Hadorn "the core element of transdisciplinary research is the question of how problems are to be identified, framed and structured within a broad area under consideration." (Pohl/Hirsch-Hadorn 2006, 40) But, how do we know that X is a problem? Wolters (2004, 347) defines a problem as the "incompatibility of some propositions (the 'problems') with the set of those propositions that are considered as true or evident." To put it in other words, a problem is what does not fit the general body of accepted knowledge; the notion of problem thus emerges as a concept of relations; it is based on the relation between two or more propositions.

Wolters's approach with the reference to incompatibility is a necessary, but insufficient condition to clarify what a "problem" is. Problems call for action and transformation; the notion cannot be restricted to propositions and general cognitive aspects alone. An integrative approach has been developed from different angles by Dörner and Pohl/Hirsch-Hadorn. They combine system theory with action theory, philosophy of science, and cognitive psychology. Although Dörner (1995) does not focus explicitly on ID, his conception of problems can serve as a framework for the clarification of what problem-oriented ID is. According to Dörner, a problem is based on a relation of three elements that encompass normative and descriptive, qualitative, and quantitative aspects:

1. an undesired (initial) state of the current situation, including an anticipation of prospective futures,
2. a desired (final) state of how the future should look,
3. a barrier, obstacle, or hurdle that hinders or inhibits the transformation of the present-day's undesired state into the desired state.

Pohl and Hirsch-Hadorn (2006) take a similar stance. They go beyond Dörner by assigning a pivotal role to each piece of knowledge: without language, knowledge, and recognition, we cannot speak of a problem. According to Pohl and Hirsch-Hadorn we can speak of a problem if and only if (1) there is a difference or divergence between (a) a target knowledge that refers to the desired state in the future ("target state") on the one hand and (b) a system knowledge that reflects the current state ("actual situation") on the other hand, and (2) the non-existence of an appropriate transformation knowledge that facilitates the transfer from the actual situation to the target state. The transformation knowledge encompasses action knowledge about how to overcome barriers by making certain decisions in order to enable specific actions.

However, that is not all to be said about the formal aspects of "problems". A temporal dimension can and should be considered. Problem-oriented ID contributes to the perception and framing of a situation as a "problem". The word "situation" can refer to an actual state or to a future state. A certain future state may be largely undesired – a dystopia – and the actual state may be the desired one, for instance regarding global change effects. In this case, a problem has not yet emerged but might or will emerge in the future. Although it does not yet exist, an anticipated problem is considered as "real"; it induces a call for action. Problem-oriented ID is inherently future-oriented. It can be regarded as anticipatory precautionary research ex ante: problems should be hindered from emerging, for example by a problem radar based on a precautionary principle and supported by methods of TA.

In summary, problem-oriented ID aims to offer system, target, and transformation knowledge, including a time-sensitive, temporal dimension and an ex ante reflection on prospective future states – this is what we call problem knowledge. The balance and interplay of the three kinds of knowledge will always remain a matter of dispute that needs agreement in different contexts. It is undisputable that problem knowledge is intrinsically interlaced with action knowledge. The notion of "problem" encompasses thus (i) the assessment of the actual or future state – from the angle of an anticipated target state – as being undesired or negative (negativity thesis) and (ii) the barrier to reaching or avoiding the target or anticipated state (barrier thesis). This notion of problem carries certain elements of action theories, including aspects of "inhibited effecting" (Wright 1991).

Prospects

One or other of the above-listed types of ID may raise concerns. Underlying philosophical convictions determine which type might be considered most important and which of the other types will just be viewed as mere inferences: (1) Realists and real-constructivist refer to given or constructed objects of reality (they prefer the ontological dimension of ID). (2) Rationalists focus on knowledge, theories, and concepts; positivists share the same orientation toward theories (epistemological dimension). (3) Methodological constructivists and many pragmatists reflect on methods, actions, or cognitive rules (methodological dimension). (4) Instrumentalists together with critical theorists and other pragmatists refer to problems and how to handle and solve problems pragmatically. The impact, effect, and consequence of ID are of utmost relevance (problem-oriented dimension). The different approaches to ID depend on underlying philosophical convictions. We cannot eliminate this plurality (cp. Schmidt 2011).

The objective of this short paper was to give substance to a specific type of ID, namely to problem-oriented ID that is claimed to be present in most TA projects. The notion of "problem" is central to the conceptual discourse about TA. In view of this relevance, "problem" has, however, not received sufficient attention and reflection. We still have problems with "problems".

References: Page 448

Between Moralisation of Politics and Politicisation of Ethics

Is There a Place for Ethics in Technology Governance?

Katja Stoppenbrink

Our institutions are of no good: we are unanimous about this.
But this is not due to them but to us.

Friedrich Nietzsche[1]

Abstract

Time and again ethics as an academic discipline has had difficulty defending its place within the variety of technology assessment (TA) concepts. The status of ethics within TA has often been the focus of specific investigations in interdisciplinary contexts. Now the integration of TA within the more recent concept of technology governance (TG) comes as a new challenge for ethics and its role in TA and TG. From a TG perspective the divergent moral discourses are integrated into policy discourse(s). Ethics, as it is understood here, conceives of itself as an academic discipline offering an expertise that is special in kind both substantially and methodologically and concerned with an overall analysis of the evaluative (normative and axiological) implications of some socio-technological innovation. These dimensions may be lost if an extreme TG perspective is adopted in which ethics is but one actor among many and tacit discursive framing as to what counts as relevant takes effect. My claim is that TG runs the factual risk of a further moralisation of politics and politicisation of ethics. These have to be distinguished from what has been described and criticised as an ethicisation of politics, which, however, may even be called for if ethics is to have a place in TG.

Introduction

In this paper I propose an examination of the implications of the shift from traditional TA to TG for the role of ethics within TA. To this end, I will first briefly determine the conception of ethics presupposed by this analysis and outline its demarcations from other notions of ethics. This implies a certain view of the task ethics performs within TA (1). I will then expound an appropriate understanding of TG and assess whether and in how far this constitutes a new paradigm in TA and a challenge for ethics (2). In the literature, three possible problems of TG for ethics are being discussed and – implicitly, so it seems – deplored. These are a (further) moralisation of politics, a politicisation of ethics and an ethicisation of politics (3). All of these oscillate between an analytical claim (conceptual implication of TG) and an empirical claim (impending consequence of TG). The latter can be characterized as a slippery slope-style argument and hence has the problematic characteristics that such an argument entails. My analysis will result in the conclusion (4) that while neither moralisation of politics nor politicisation of ethics are a necessary upshot of TG, a further ethicisation of politics may be called for if ethics is to defend its place in a TG environment.

On the Conception and Understanding of Ethics and Ethics Within TA

Since even in academic philosophy there a several, mutually exclusive understandings of ethics, it needs to be specified what is meant by it for the purposes of this paper. I presuppose the conceptual claim that ethics refers (a) to an academic discipline offering an expertise, which is (b) both substantially and methodologically special in kind and which (c), if applied in TA, is concerned with a comprehensive analysis of the evaluative (normative and axiological) implications of some given, actual or potential, socio-technological innovation. This implies rejecting, for instance, the following views on what might be an adequate understanding of ethics. First, I reject the assumption that ethics is only a eudaimonistic concept merely concerned with individual happiness and good life. This focus, often attributed to ancient ethics, would be too narrow in determining the substantial scope of what is meant by ethics for present purposes. Second, I reject the view that ethics is but a synonym for moral philosophy. This is a frequent conceptualisation of the discipline of ethics; however, ethical theory is not only concerned with problems of conflict resolution in interpersonal relations but also with questions associated with individual and collective good life. The disciplinary scope of this second view would thus be too narrow. Finally, in this paper I presuppose that ethical judgments are not mere expressions of (emotions of) approval and rejection. This meta-ethical position would imply a non-cognitivist stance denying that ethical judgments are truth-apt, ultimately excluding the possibility of ethical expertise. As it is understood for present purposes, ethics can be regarded as non-empirical value theory, an academic endeavour and an expertise (in the process sense of the word) conducive to truth-apt judgements (result sense), i.e. judgements which can be true or false.

Ethics has a fragile but stable status within TA. Whatever the preferred approach of TA, its focus is to analyse, foresee, enlighten, and clarify the actual or potential effects of a socio-technological innovation, be they risks and side effects or sufficiently foreseeable reactions by different groups of stakeholders. Embracing an understanding of ethics as set out above, ethics in TA is concerned with the axiological implications and the normative acceptability (justifiability) of uncertain or certain risks.

Technology Governance: A New Paradigm of TA and a Challenge for Ethics Within TA?

TG has an integrating, systemic focus. The point of departure is not from a given, actual or potential socio-technological system, process or device, but rather from the perspective of the interplay of different social actors (including institutional actors) and their attitudes, proactive stances and reactions to possible challenges from innovation processes. According to this model a variety of voices are being uttered and have to be heard and taken into account in any technological innovation process. While policy-oriented TG (TG in the political sphere) is about the integration of possibly antagonistic reactive attitudes of manifold actors, the traditional focus of TA is to assess risks from a putative Archimedean point. TG, however, is based on multi-level cooperation and requires complex coordination, both horizontally (among citizens) and vertically (civil society vs. political institutions). Thus, TG is a complex regulatory paradigm combining descriptive features with evaluative assumptions. We have to distinguish the connotations of TG in a normative perspective, in which it is associated with (hopes of) better governance and regulation, from the political science perspective on TG as an analytical tool used to single out and describe the various actors of relevance in a given process of technology regulation.[2]

Factually, ethics (academic ethics, ethics within TA) is but one actor in this multitude. Even if it conceives of itself as rational expertise conducive to judgments of a high epistemic quality, its voice is more likely to be ignored in a TG than in a classical TA context. To illustrate this we may draw on the example of the debate on genetically modified organisms (GMO). While according to a straightforward ethical analysis based on scientifically sound evidence a certain project to develop and release GMO might – arguendo – not create any unjustifiable risks so that continued opposition to this project would ultimately have to be regarded as irrational, in a TG perspective a reassessment of the role of emotions and (putatively irrational) concerns in risk perception would be in order. In an ongoing case in Key West (Florida) most of the resident population accept the release of GM mosquitoes to combat a species of mosquitoes (aedes aegypti) which can transmit dengue fever. Still, many people have expressed vehement opposition to this public health plan.[3] From a TG perspective these voices cannot be overruled by reference to the (alleged) risk assessment results but have to be integrated into the authorities' decision-making process.

Moralisation of Politics or Politicisation of Ethics Through Technology Governance?

As an example for a possible politicisation of ethics (Briggle 2009) we may refer to the Ethics Commission For a Safe Energy Supply, consulted by German federal chancellor Angela Merkel in 2011. The Commission was convened as an ad hoc advisory body in the aftermath of the Fukushima incident in March 2011, which made Merkel radically change her mind on energy policy. The Commission issued its report entitled "Germany's energy transition – A collective project for the future"[4] in May 2011. The politicisation consists in the formal aspects of the commissions appointment: its ad hoc character, its narrow source of legitimacy (close to decisionism), its arcane selection criteria (personal preferences?);

moreover the nature of the commission's report, the objectives of which were determined in advance, as a means (a piece of commissioned work) to a well-specified end (political acceptance provider). In sum, this is the deployment of ethics as a political instrument and can be termed politicisation of ethics.

Critics have charged the commission with moralisation of politics, too. According to my conceptual sketch this is the increasing use of moral arguments or appeals to morality in politics where morality is understood as individual or collective moral intuitions or elements of moral worldviews (close to Rawls' comprehensive doctrines). Indeed, there were a considerable number of representatives of Christian institutions among the appointees. In an interview they claimed that energy transition had to be regarded as part of the "integrity of creation" and a "biblical command".[5] Conceptually, such a statement can be subsumed under moralisation of politics.

Grunwald (2013) has examined the fundamental but often confused distinction between "Ethisierung" and "Moralisierung". Roughly, ethicisation refers to a growing significance or influence of ethical expertise in socio-technological innovation and regulation processes. Moralisation describes a shift in the public debate, in formal and informal deliberation processes in which the importance and (rhetorical) impact of moral arguments is on the rise. In line with my understanding, arguments are termed moral in kind if they refer to individual pre-reflective moral intuitions.

In my view, TG runs a factual risk of a further moralisation of politics, whereas what ethics within TA aims at is ethical education or even – with all its connotations – ethical enlightenment (Grunwald 2013, 243: "ethische Aufklärung"). The evaluative dimensions taken into account from an ethical point of view may be lost in adopting an extreme TG perspective in which academic or professional ethics is but one actor among many. TG is prone to facilitating a decline in the significance of academic or professional ethics in technological innovation and regulation processes rather than to maintaining the further momentum of these actors. The opposite claim would be to diagnose a further ethicisation of technology conflicts (Bogner 2011). In my judgement, since the place of ethics in TG seems less stable than in traditional TA, this is a factual question contingent upon the nature and direction of the respective policy processes. Thus, further ethicisation of politics in Grunwald's educational sense is not likely to be expected from an increased orientation towards TG. Instead – and this is more important from the viewpoint of academic or professional ethics – the follow-up question is whether and how this cleavage between ethics and TG may be compensated, lessened or overcome.

An avenue to pursue may be to acknowledge the fact that framing effects are of serious significance in a TG perspective. Since there is no external Archimedean point in TG, one cannot even say that framing effects distort technology regulation. As is well known, framing is significant, e.g., in risk perception; but there is framing in the most general sense in determining what counts as relevant. Such (tacit) discursive framing (Torgersen/Bogner/Kastenhofer 2013) is not anything that just happens but can be instrumentally

and intentionally aimed at and employed by all stakeholders in a TG process. This makes a case for ethics in that its function is to offer a policy and public[6] counselling even amongst the dissonant chords of the participants in a technology governance concert. If the factual effectiveness of framing and other means of agenda-setting boils down to the question of 'which voices cannot be overheard in the TG choir' there is room for ethical expertise with its clarificatory and educational objective – vis-à-vis the traditional political institutions but also vis-à-vis the other participants in the process. This leaves open the questions of, first, whether assuming this educational role and becoming pro-active in policy counselling constitutes the entire range of feasible stances for ethics to adopt within TG and, second, whether the ethicisation of politics, i.e. the affirmative role of providing ethics advice in policy processes, might not be a good idea after all.

Conclusion

We have to distinguish between ethics as an on-demand political instrument such as in the case of the Ethics Commission For a Safe Energy Supply (demand-pull politician-driven politicisation of ethics with a risk of a moralisation of politics) and ethics as an independent and impartial actor in a TG process (supply-side education-oriented ethicisation of policy processes). The latter may even be required practically if ethics is to play a role in TG so that arguably it should be pushed ahead intentionally by professional ethicists.

There are broader and perhaps more interesting questions looming on the horizon. These concern the legitimacy problems of governance models for politics and for participatory democracy in general. I am referring to questions of implicit power asymmetries and the unequal accountability of public and private actors. Conceptualizing and practically exploring the role of ethics within TG is not merely a local problem but needs to be situated in a larger theoretical framework of the relations between ethical theory and (deliberative and[7] participatory) political practice.

References: Page 449

TTIP and How to Cooperate between Technological Assessment and Emotion

Bettina Rudloff

Abstract

The European Union (EU) is both the largest exporter and importer of agricultural products in the world. This trade in agricultural products is influenced by a number of political measures like tariffs and, increasingly, by so-called nontariff measures (NTMs). These NTMs address a set of different instruments, among which are standards like threshold values for pesticide residues, production requirements on hygiene, as well as packing- and labeling standards. In fact, such measures can have a much stronger impact on the costs of trade than tariffs. Reducing these NTMs in order to generate economic growth is part of trade negotiations like the current Transatlantic Trade and Investment Partnership (TTIP) between the EU and the US. However, these transatlantic negotiations have become challenging as well, such as due to food standards. How can compromises be found if regulatory traditions and the role of scientific assessment differ between the actors?

Enforceable WTO Rules to Address Technological Impact Assessment of Food Safety

In the context of food trade, there is a long-standing tradition of rules on certain types of technological assessment (TA) which have become quasi-binding. There are references to them in agreements of the World Trade Organization (WTO), which has a strong enforcing capacity due to its dispute settlement system. Technological assessment is ruled by the WTO's so-called risk assessment, which is the scientific part of its overall process of risk analysis. This encompasses the political level of risk management and the participative level of risk communication (Codex Alimentarius 2007).

The relevant institution to which the WTO refers to is the UN Codex Alimentarius Commission (CAC) founded jointly by the UN Food and Agriculture Organization (FAO) and the World Health Organization (WHO) in 1961. The CAC established general rules on how to operate risk analysis; how risk assessment should consider what is deemed as relevant information, and how to treat uncertainty. Regarding the political level of risk management, CAC recommends that this political level be institutionally split from scientific risk assessment in order to support scientific integrity. The EU followed this approach after the BSE crisis.

It established the European Food Safety Authority (EFSA) in 2002, which was given the given responsibility of risk assessment. The political considerations remained the domain of the political actors at the EU Commission (DG Sanco), the Ministerial Council, and the European Parliament, which define political decisions in terms of legal acts. This separation is intended to support the integrity of science. However, since the science is taking place within differing cultural contexts, the distinction has not provided the theoretically claimed 'objective and neutral' wisdom.

In addition to these procedural rules, the CAC also sets specific product standards, e.g., it adopts maximum residue levels. These standards symbolize the existing scientific consensus among UN member states that are members of the CAC. Some of these standards, however, have existed since the commencement of CAC 40 years ago. Newly arising technologies often have not resulted in the adoption of multilateral standards.

Existing standards became quasi-binding at the WTO level as the WTO considers their scientific acceptance as a justification of trade barriers. If imports are not fulfilling the regulatory standards, they can be rejected by the importing country without being defended by the exporting country.

Details on using standards are covered by the WTO Agreement on Sanitary and Phytosanitary Measures (SPS). It addresses trade rules on food and plant and animal products that may lead to conflicts at borders if countries apply different safety levels.

In principle, each WTO member may apply its own food safety level (Article 2). However, some additional rules define that

- the safety level must follow the internationally accepted standards of CAC (Article 3) or
- any stricter standard has to be justified by a scientific risk assessment (Art. 5). For this risk assessment an internationally accepted procedure has to be applied (CAC 2007): risk assessment is not necessarily limited to quantitative factors to define probability and adverse effects, but it has to result in clear indications of damages, exposure, and potential occurrence. In case scientific evidence is lacking, a stricter standard can be applied provisionally (Art. 5.7), but the risk assessment must be provided later and evidence must then be proven scientifically. The exact deadline for this later risk assessment is part of disputes but often has to take place within less than two years. This ruling on stricter standards than WTO reference standards initiates harmonization.
- implementation of the trade measure, if justified by either the CAC standards or a risk assessment, can be quite strict. Even rigid import bans are allowed if the underlying standard is justified. Economic factors and the feasibility of a measure should be considered (Art. 5.3 and 5.6) when choosing a specific measure to enforce a standard, such as an import ban or labeling .
- if the measures of trade partners diverge but each aims to maintain identical safety levels, then equivalence or mutual recognition is recommended (Art. 4). Equivalence means that trade partners accept that a limited list of standards (positive or negative list) is valid for selected products. The responsibility for proof of similarity lies with the exporter. Mutual recognition (MR) goes beyond selected products and leads to the acceptance of the whole regulatory system and thereby the standards of all the trading partners.

Traditions in Regulating Food Across Trading Partners

EU as a Model: Overview on Typical Cross-Countries Regulation

The EU represents the most advanced model for integration in the world. There is a long tradition of treating different countries' diverging standards, and this may serve as a model for different treatments of nationally diverging standards (Rudloff 2014).

Depending on the overall political framework of EU policies towards a certain third country and the character of the third countries, several modes are applied by the EU with a decreasing degree of harmonization:

(1) <u>The Common Market</u> is the strongest mode and applies EU-internally to member states. It reflects harmonization and requires mutual recognition in the sense of fully accepting each other's food regulatory system. Certain deviations are sometimes allowed in exchange for stronger standards.

(2) <u>Accession</u>. Candidate countries must apply the EU's rules ("acquis communautaire") as condition for accession to the EUs common market. This symbolizes an asymmetric harmonization at the EU level, as such candidates have to adjust completely to the EU system. The EU usually supports this path long term by helping the candidates establish relevant institutions and systems.

(3) <u>Selected Mutual Recognition</u>. Some countries with historically close relations to the EU or for which close relations are envisaged can also integrate nearly all of the EU rules. Often cooperation or even participation in EU institutions is envisaged for the countries of the European Economic Area (EEA: Norway, Iceland, Liechtenstein) and, for example, Switzerland. The bilateral agricultural agreement with Switzerland foresees individual mutual recognition of selected veterinary standards and relies on positive lists. With the new European Model of Deep and Comprehensive Trade Agreements (DCFTAs) as part of its European Eastern and Southern Neighborhood Policy, the EU specifically aims at lifting standards hindering the trade of agriculture and food. This has however so far been very challenging and has only been a limited success with a few partners. In particular, negotiations with Morocco have thoroughly advanced but with Jordan, Tunisia and Egypt they are only in the very early preparatory phase. Other MR agreements refer to categories of products like for organic produce. There exists respective agreements, e.g., with USA, Canada, Switzerland and Japan.

(4) <u>Equivalence</u>. On the matter of 'food of animal origin' there have been several long-standing veterinary agreements (VET), (USA, Canada, New Zealand, Mexico). Once a comprehensive trade agreement is negotiated, prior VETs are integrated. Their coverage

can differ between trading partners, as can the degree of equivalence that is individually negotiated (Figure 32).

(5) ‘Cooperation’ refers to a looser and more procedural type of bilateral compromises which exist with a set of other third countries, such as the USA (in place since the end of the 1990s). In many trade agreements, specific chapters on further cooperation pertaining to SPS issues exist, but without defining common standards (EU-EPAs, Korea, Chile).

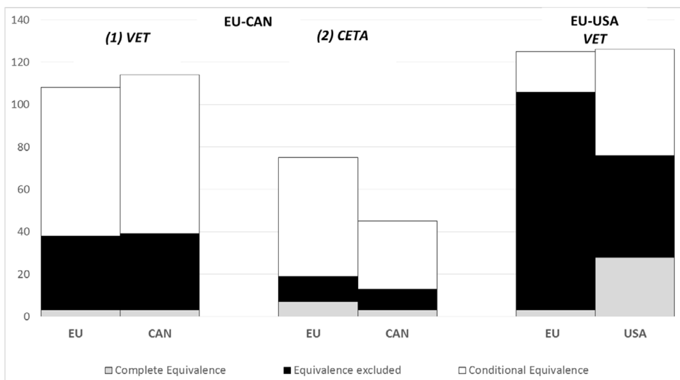


Figure 32: Flexible Equivalence (numbers of acts referred to). Source: Rudloff 2014.

Specific Transatlantic Differences

Food standard systems in the EU and the US differ in many respects. There are differences in terms of process requirements, e.g., how to detect animal epidemics (“procedural rules”). And there are differences in terms of the risk levels set for food policy (“risk tolerance”). Some underlying general conceptual differences can explain the recent tensions in negotiating the TTIP:

(1) The guiding principle of the EU is the precautionary principle laid down in the EU Treaty of the Functioning of the European Union (Art. 191 TFEU). Accordingly, regulators are obliged to protect public health if companies cannot prove that the use of a certain substance is harmless. In contrast, the guiding principle in the USA refers to an after-care principle. Here, the public administration first has to prove a harmful effect of a product before it can enact a ban. This evidence-based approach is often interpreted as purely scientific and objective, whereas the European method is judged as being led by subjective fears and emotions. The American approach is embedded in the American tradition of legal liability to compensate for damages.

Both methods simply reflect different approaches to risk policy. However, they lead to conflicts at the WTO level, and as the US-approach is closer to that of the WTO, the EU is the party that confronts problems. Therefore, new EU-based substances and products are banned much more often than the new USA products. Per definition European complete

bans reflect stricter standards - in fact they are zero tolerance levels - than those of the WTO, mostly allowing certain maximal levels. The EU standards are therefore more likely to be attacked by the WTO and need to be justified by risk assessments. In the cases when the USA places a ban on a product (e.g., marketing of a raw milk product), there are usually no international reference standards which could serve as the basis for a complaint at the WTO. Consequently, the EU often loses against the complaints of the USA (Rudloff 2014).

(2) The regulatory focus of the EU is more on the whole production process than on the final product like in the USA. This comprehensive approach means high requirements for every single production step within the value chain. Germ load of meat should be prevented by continuous hygiene, starting at the farm and ending on the consumer’s plate (‘farm to fork’). This chain-approach entails measures which enable backtracking by identification chips for animals, but also requires detailed documentation by farmers and retailors. The US addresses the safety level of the final product, e.g., by decontaminating chicken carcasses with chlorine.

	EU	USA	WTO-Case
Principles on risk tolerance			
For meat			
_Decontamination			
… with chlorine	⃠	√	Still no decision
_Use of performance enhancers	⃠	√	EU convicted
_Use of antibiotics			
… as performance enhancers	⃠	√	
… veterinary use in organic farming	√	⃠	
Procedural Rules			
For genetically modified food			
_public license registry	√	Non-existent	
For animal and plant epidemics			
_regionalization approach	Region often differentiated	Region often only state	

⃠: prohibited, √: allowed

Table 27: Transatlantic differences on processes and risk tolerance. Source: Rudloff 2014.

TTIP targets greater convergence by narrowing these differences. Existing welfare estimates indicate that welfare gains will mainly be due to the narrowing of such standards.

Overcoming these differences has caused significant fears, especially among EU member states like Germany and Austria. However, an open-ended question which continues to permeate the discussions is whether TTIP will necessarily result in regulation to achieve harmonization in America.

How to Overcome Diverging Concepts of Food Regulation?

It is important to bear in mind that harmonization is the exception rather than the rule (chapter 2) – even within the EU, as harmonization has not even been completely achieved in the most integrated market in the world. Approaches exist with regard to how to overcome differences that have already been proven successful:

- Flexible Equivalence. Equivalence is never a "neither-nor" decision. In existing veterinary agreements, it is tackled very individually, and especially the EU was very rigid on excluding even certain products from being treated as equivalent (Figure 32). The purpose of the bulk of rules is to set conditions for potentially accepting equivalence later. As the Trade Agreement with Canada (CETA) has already demonstrated, one can also draw conclusions on how former veterinarian agreements are replaced by general trade agreements. CETA addresses fewer products than the former VET, however fewer rules are now excluded as a result of negotiations.
- Regulatory cooperation can build the basis for exchanging opinions and foster a common understanding between partners. This is envisaged in both CETA and TTIP. A forums – CETA now uses the term regulatory cooperation forum since the previously used term regulatory cooperation council drew criticism due to its legal character - will not replace the legal regulatory actors at home. But it may proactively define a common level playing field on issues related to future standards. Therefore, it will be important to determine how open the composition will be. It should not be open only to technical experts and potentially the industry, but also to consumer groups and NGOs and even to the representatives of third countries affected by changes in the standards.
- Bargaining. The EU could have persisted with its previous standards, even if those standards did not comply with WTO rules and even despite losing a WTO dispute. This was the case in the EU-US Hormone Beef case (DS 26) and in the EU-US GMO case (DS 291). In the first case, as a solution the EU offered improved market access for hormone-free beef but kept its import ban on beef produced with the help of hormones. Such a compromise may also be possible to resolve the conflicting positions on chlorine chicken. In the second case, the EU passed the risk management to the member states, which can decide to allow GMOs or not, based on non-scientific reasons.

Conclusion: Technological Impact Assessment Plays a Large and Highly Political Role for Food Trade

Food trade has a long-standing tradition founded on scientific assessments. This risk assessment even became legally binding within the WTO dispute system. However, even scientific assessment is part of general cultural and political traditions. Therefore, science can never provide an unambiguous base for political decisions shared by all parties. Political flexibility will remain necessary to resolve future trade conflicts, as it has proven success in the past, e.g., in the hormone beef case.

References: Page 449

The Importance of Strong Science Journalism in Technology Assessment

Impression Panel Discussion

Joost van Kasteren

Abstract

In technology assessment (TA) the potential impact of scientific and technological developments is evaluated and the results are brought to the attention of citizens, policymakers and politicians with the goal to promote public dialogue on these issues and hence improve decision-making. The panel discussion focussed on the important role the media play in the agenda setting and framing of the public debate. As such they could be important allies for TA institutes. Conversely, journalism, especially independent (= strong) science journalism, could benefit from the insights gained in TA in interpreting scientific and technological developments and their social consequences. A pre-emptive question that came up during the discussion is how science journalists can play their democratic role as watchdog of the scientific enterprise at a time when traditional media find themselves in crisis due to the rise of the Internet and social media.

Introduction

Science and technology play an important, if not decisive role in shaping the society of the future. Whether it is about nanotechnology, robotics or genetic modification, technological developments largely determine how the society of tomorrow and the day after tomorrow will look. Part of the answer to major societal challenges (food, energy, climate change, ageing) depends on research and innovation. Technology assessment (TA) attempts to evaluate these developments and their potential effects in a systematic way and to identify and promote public dialogue on these issues, aiming for better decision-making. Good science journalism essentially does something similar, but is mainly driven by topicality. While TA focuses on the undercurrents, i.e. the long-term developments in science, technology and society, the task of journalists is mainly to bring news and put them in perspective. In a variation on the saying 'journalism is literature in a hurry "- attributed to Matthew Arnold (1822 - 1888), one might say that "science journalism is TA in a hurry."

Crisis of Science Journalism

Journalism as we know it is going through a crisis or rather through a transition phase. The Internet and social media put pressure on the traditional business models for newspapers, magazines and broadcast media, and everybody is looking desperately for alternatives. At the same time there is a growing need for strong, independent science journalism. The pressure on scientists to publish or perish, the competition for funds, the growing entanglement with business and the struggle of universities to get a good ranking create perverse incentives. Science is no longer the disinterested quest for truth – if that has ever been the case. Especially these last few years have shown that these perverse incentives can lead to sloppy research, exaggerated promises and even outright fraud.

Researchers and research institutions also present themselves much more emphatically than before in the old and new media. Researchers write popular science articles, appear on stage in science cafes and other venues, are interviewed on radio and TV programs and are very active in the blogosphere. At the same time the ever-expanding public relations departments of universities and other research institutions are "bombarding" us with press releases, interviews and background articles that can be used more or less unchanged by the media.

Sometimes these PR departments are trying to control media coverage as much as possible by imposing embargoes, putting a spin to unwelcome information or even foreclosing researchers against critical journalists. The PR people know the tricks of the trade, because quite a few of them have been working in journalism and have changed to what they informally call "the dark side".

On the other hand science journalists are to blame as well. They often lack enough distance to the object of their journalism. Too often their reports are guided by their fascination for science and/or their loyalty to the scientific community. This phenomenon is not limited to science journalists, but is even more common among general journalists, particularly those who are working in audio-visual media. One moment they try to floor a politician by questioning him very critically, and the next moment they worship the next guest who happens to be a scientist. It could be comical were it not for the fact that the lack of distance, of a more critical attitude, makes the journalist go along with the exaggerated promises of researchers and their PR advisers and close their eyes to the negative sides of the scientific practise. Moreover, many freelance science journalists need to supplement their meagre income from journalism by writing articles or making films on assignment, often for the same research institutes they are supposed to follow critically.

Because of this lack of distance towards science it often happens that the reporting is taken over by other desks, like that for politics or the economy as soon as a technical or scientific issue becomes controversial. Apart from that there are media that still live by the old belief that a journalist should be able to report on any subject whatsoever, regardless of his or her background. The problem is that these reporters often have not enough background in science to at least explain the technical or scientific aspects of the controversy.

As media largely determine the political agenda, these issues are presented on the agenda in a way that not only does no justice to the theme, but also can lead to wrong decisions. An example is the controversy over genetic modification, where journalists without a science background, have given much more media attention to horror stories about this technology than they deserved. This has resulted in a stalemate about the use of these techniques in plant breeding. Problems like this could and should be avoided for instance by closer cooperation between science journalists and their colleagues from other desks or by training these colleagues to make them more science savvy.

New Modes of Science Journalism and TA

The digital revolution is not just doom and gloom for science journalists; it also creates new opportunities for "TA in a hurry". Hence it is better to speak of a transition rather than a crisis. A number of possible business models are being developed. One example is "forksning.no" an online news magazine in Norway with a staff of 14 journalists. It is published by an independent organisation that is funded by a large number of research institutes and universities. As there are so many organisations involved, each providing only a small part of the funding, the editorial office is de facto independent.

Another model is the establishment of special foundations for funding science journalism, just as there are foundations to provide support for investigative journalism. In general, a large part of the costs of investigative journalism (time, travel) is funded by the foundation, while the media pay only a modest amount for the articles or broadcasts that ensue from the investigation. An example is U.S. ProPublica (www.propublica.org). A similar model lies behind some (online) magazines that are paid for by foundations getting their money from private funds. An example is the online magazine Inside Climate News, which is located in the US as well.

A lot of funding for independent science journalism could be made available if research institutes and universities would reduce their PR departments instead of enlarging them. The science communicators at these departments could then return to the 'light side' and become journalists again. Chances are, though, that these initiatives would develop into science media centres, comparable to the one that already exists in the United Kingdom. By not keeping enough critical distance towards science and its institutions, such an initiative could become another voice of science.

TA aims to assess scientific and technological developments and their social consequences. The task of the science journalist is to report on current scientific and technological issues from the perspective of the audience. He is a bit like the foreign correspondent reporting from abroad to the people at home. He chooses his subjects and his angles on the basis of what he thinks is relevant for his audience at home. Usually this is different from the subjects and angles that are considered relevant by the journalists in the country in which the correspondent lives and works.

The same goes for science journalists. The choice of his subject and the angle from which he approaches it are different from the choice and angle of a blogging scientist or a science communicator from a university or research institute. Theirs will always be based on the importance of their research subject, their career or their research institution. As a matter of speaking, they will 'translate' scientific information for the layperson; the independent journalists will interpret and try to explain what the scientific research means for his audience. Because of the previously mentioned fascination with science and loyalty to the scientific enterprise, the danger that the science journalist will "go native" is always lurking.

An independent attitude of the science journalist is important because in a democracy, journalists should act as a watchdog. Because science and technology play an increasingly important role in social and political decision-making (evidence-based politics), it is essential that the watchdog function is extended to scientific practice and the scientific community; if only because between 1 and 3 per cent (depending on which country) of gross national income is spent on R&D. The watchdog function is not just about presenting and interpreting the results of scientific and technological research, but also about critically monitoring scientific practice and its funding: Who decides which research programs are carried out and on what grounds? Do we need another several billion spent on the successor to the LHC for fundamental research into particle physics or can we make better use of that kind of money for the development of more efficient solar cells? How is research conducted and reviewed and by whom? Which interests play a role? Is the research repeatable? Is it relevant?

Science journalists can benefit greatly from TA in fulfilling their watchdog function. TA studies are often about social and ethical aspects of scientific and technological developments and thus provide a tool for the selection of themes and the angle of the journalist who wants to write about that theme. The recently started discussion about germ line engineering fits seamlessly in the discussion about the use of technology for human enhancement and the blurred boundary between people and better people, which was started a long time ago in TA.

TA can also help journalism to frame issues in a more balanced way. A popular journalistic frame with respect to controversial issues is that of pro and contra, black or white. It does not really matter what the subject is - climate change, genetic modification, CO2 storage or HPV vaccination – by presenting a pro and contra view, success is assured in the form of public attention and praise from colleagues. Such black and white frames not only work at the expense of the facts, but also do not do justice to the stratification and thus the complexity of the problem and often hinder the view for potential solutions.

Conversely, science journalism can also play a role for TA and especially when it comes to stimulating the public dialogue on a particular theme. The traditional media - and, increasingly, social media - play a decisive role in determining the social and political agenda, i.e. the issues that people talk about and get agitated over, and about which questions are eventually asked in parliament and policies are developed. So to be able to start a public dialogue, it is important for TA researchers to get their issues on the public agenda. That is not easy and sending out a press release is no guarantee that you will get attention in the

media. To get issues higher on the public agenda TA researchers and institutes will have to invest in good relations with journalists. That is about as far as it can go. Journalists will not enter into partnership with TA researchers or institutes because it goes against their method (intuitive) and against their ideal of independent (science) journalism.

Conclusion

Despite, or perhaps because of the fact that journalism is undergoing a major transition, there are good opportunities for independent (strong) science journalism. The condition is that science journalists keep more distance from their subject and are able and willing to inform their audience about the less positive aspects of the scientific enterprise. TA can help journalists in the critical analysis of the scientific community and in interpreting results of scientific research from the perspective of their audience. Conversely, science journalism is important because the media largely determine the social and political agenda. Because of the differences in culture, purpose and method between journalists and TA researchers, there is little or no basis for structural co-operation, but improving mutual contacts, for example through informal briefings on current controversies, it is beneficial to both parties.

Using Short Films for Public Engagement with Synthetic Biology

Wolfgang Kerbe, Antonina Khodzhaeva and Markus Schmidt

Abstract

Synthetic biology is an emerging techno-scientific field, aiming to contribute to the future bioeconomy. With the advancement of the research in this field, many societal, ethical and environmental questions and issues arise. In this article we present the results of an engagement experiment which took place during the 2nd European Technology Assessment Conference in Berlin in February 2015. The discussion of 25 participants which aimed at the societal implications of synthetic biology was triggered by several short film presentations. We claim that the role of cultural products, in this case the BIO·FICTION films, is an important instrument for public engagement with synthetic biology. The fictional portrayal of science can offer opportunities for critical reflection about emerging technologies and their societal ramifications. We conclude that the use of thematically relevant films as stimulus for a lively debate on emerging technologies is a promising and appealing approach.

Introduction

Synthetic biology is an emerging field of research that comprises knowledge, approaches and methods of biotechnology, engineering and related disciplines with the overarching aim to create organisms with novel characteristics. According to SCENIHR (2014), "synthetic biology is the application of science, technology and engineering to facilitate and accelerate the design, manufacture and/or modification of genetic materials in living organisms". Potential applications of synthetic biology can contribute to a new bioeconomy, to the medical sector and may provide solutions to environmental challenges. With the advancement of research in this field, many questions and issues, both already familiar and new ones, arise. These issues concern, for example, ethical implications associated with the creation of novel living organisms, legal aspects of biosecurity as well as the fair distribution of possible benefits from the use of the new technology (see e.g. Schmidt et al. 2009). In order to engage a wider audience in a debate on such issues, novel attractive approaches have to be found. Therefore we set out to experiment with a new session format to be used for this purpose.

The results presented here are based on a session which took place during the 2nd European Technology Assessment Conference (PACITA) in Berlin on 26 February 2015. Several films (see Table 28) were shown to participants and then discussed in small groups. The session focused not only on the societal implications of synthetic biology. It also dealt with the role of cultural products, such as films, in science engagement and the opportunities for critical reflection on emerging technologies and their implications that the fictional portrayal of science can offer.

The films were originally screened during the BIO·FICTION Science Art Film Festival[1] which took place in October 2014 in Vienna, Austria. The aim of the festival was not only to engage scientists, social scientists, biohackers, artists and filmmakers in a discourse on synthetic biology, but also to address ambiguities and paradox aspects of the field itself by offering an unconventional programme. During the PACITA session some of these aspects were also addressed using films to stimulate a lively interaction between the participants.

Cultural Products and Narratives in Public Engagement on Science and Technology

The questions of how to and why engage a broader public in decision making about technological developments are very challenging in STI governance (Miller and Bennet 2008, p. 599). In some cases, issues for deliberation can be very complex, "intimidating or uninteresting" (Long and Ostman 2014, p. 62) for lay public and an ordinary citizen. In this context, film and fiction can be more appealing:

"Why should the public be engaged in deliberations about technological choices? It is not always clear how technological choices may impact the things people care most deeply about. (…) Science fiction, by virtue of the centrality of narrative and myth – the very quality most despised by the technical realists, and yet crucial to effective public communication – can help overcome this barrier and engage people's deep-seated, cultural sensibilities about what is significant and important in life" (Miller and Bennet 2008, p. 601).

Films can offer a good ground for reflections and discussions about wider ethical and societal implications, the current state and the future developments of emerging technology, and give the broader public an opportunity to engage in complex issues without the necessity "to present or defend their own opinions, at least initially, increasing their confidence and comfort" (Long and Ostman 2014, p. 62). Another important contribution of films and cultural products in general is that they provide a possibility to engage in a discussion about long-term technological developments, serving as a sort of scenarios (Schwarz 2015, p. 511). In the discourse about synthetic biology it is becoming especially relevant, as the current discussion focused more on the potential and possibilities of this emerging technology (Schmidt et al. 2013, p. 3).

Problematization and Frames

One way to analyze the perception of synthetic biology is to utilize Foucault's notion of problematization and the theory of media frames (Bogner and Torgersen 2014). Biotechnology in general has been predominantly discussed within three different modes of

problematization, namely risk, ethics and economy. The three different modes are connected with different key questions, forms of policy advice, modes of participation and different regimes of legitimisation of decisions regarding the technology. With the interdisciplinary character of synthetic biology, new fields of influence enter the stage. The genealogy of its problematization is not only connected to biotechnology, but comparators with IT and nanotechnology gain momentum (Torgersen and Schmidt, 2013). Another possible way of looking at synthetic biology is that of the DIY biology, or "biohacker" community, that demands a renegotiation of power in the access to scientific knowledge in addition to cultivating a certain "coolness" factor in the context of the new emerging technology. Schmidt et al (2013) systematically analyzed the contributions to the 2011 Bio:fiction film festival in Vienna[2] which already showed movies around the topic of synthetic biology. The authors showed that synthetic biology was not only depicted within the frame of conflict that was associated with biotechnology, but also compared with IT and nanotechnology, associated with a "gadget" and "progress" frame respectively. This set of problematization regimes, frames and comparators, however, is not limited to the few mentioned above and the dynamic development of synthetic biology could also create new perspectives for a debate on novel technosciences.

The films of the second Bio:fiction festival in 2014 also refer to different modes of problematization. Our engagement experiment on the one hand utilizes these different regimes as a stimulus for a lively debate, on the other hand the outcome of the discussion can show if the categories established so far also show up in the groups' associations concerning the films or if anything new – a new form of problematization – enters the stage.

Method Description

The session "Interactive BIO·FICTION Film Lounge" took place during the 2nd European Technology Assessment Conference in February 2015. The conference attracted specialists and professionals engaged in topics like technology assessment, public science and technology participation as well as citizen science. So the aim behind the organization of a session during this conference was to attract participants interested in the field of public engagement. Any registered participant of the conference could attend the session. Approximately 25 people did this, among them were junior and senior researchers, social scientists and PhD students. Some of the participants were familiar with the field of synthetic biology, to some of them it was new.

Session Format

Firstly, we presented the aim and the session plan to the participants. After this short introduction to the session, the selected films were screened. Then the participants were divided into three groups. Participants elected the hosts of each table to present the results of the group work at the end of the session. Each group received the task to discuss films with regard to the following questions:

- Which issues are raised in the film?
- How are these issues connected to the field of SynBio?
- What are your associations with/impressions on the issues depicted in the film?

Group discussions were divided into three rounds during which each group discussed and compared two different films, answered the questions mentioned above and debated. Each round lasted approximately 12 minutes. When a facilitator gave a signal, the groups, apart from the table host, rotated around the room to the next table and discussed the next two films. After every group had discussed every movie, each host of the tables presented the results of the group discussions. It is important to note that several flip chart papers were prepared at each table with the names of the films on each paper. Groups had to write down the results of their discussions. At the end of the group work, each poster contained the results of three rounds of discussion of each group. In total, the session lasted approximately 1.5 hours.

Selection of Films

From a wide range of 60 different films shown during the BIO·FICTION Film Festival,[3] six films were chosen for the PACITA session. Film descriptions are presented in Table 28, which also summarizes the way in which films were presented to the participants for the discussion session.

	Description of Films	
1	Film 1: Reinventing the Dodo (Steven van Eekelen / 2013 / length 03:08 min) This highly entertaining animation explores what could happen if the Dodo were to be resurrected.	Film 2: BioFlaneur (Aleks Cicha / 2014 / length 02:20 min) This short film speculates about a future where invisible biological data of spaces and humans is uncovered.
2	Film 3: Bioluminiscent Streetlamps (Steven van Eekelen / 2013 / length 02:22 min) This animation paints a picture of how a future light-emitting tree that could serve as a sustainable alternative for street lamps could look like.	Film 4: Exploring Indonesia (Ari Dwijayanti / 2013 / length 02:50 min) The vast development of synthetic biology brings a large number of innovative applications, and Indonesia, located in the most biologically diverse region on the planet, is well placed to explore the possibilities.
3	Film 5: Copy and Clone (Louis Rigaud / 2010 / length 03:15 min) “Copy and Clone” displays the effects of biotechnologies on animal food industries through the window of a computer.	Film 6: Quanticare (Amy Congdon, Jenny Lee, Ann-Kristin Abel / 2012 / length 02:23 min) The film takes a look at an imagined future healthcare company and the role of synthetic biology, which will revolutionize and advance healthcare.

Table 28: Description of films

The selected films all showed a clear relation to the field of synthetic biology and raised different societal issues while still being short in time (about 3 minutes). Films were selected due to different modes of problematizing synthetic biology (see above), although the main idea behind the selection was the pairing of more positive with more negative representations, so that each group/table had a pro and con pair to discuss. However, the more critical films included some ambiguities as regards the general attitude towards synthetic biology and nevertheless were closer to the risk and ethics mode compared with

the “positive” films in column two that rather reflected the economy mode and even the new category of “coolness” (see also Bogner and Torgersen 2014).

Results

The following section presents the results of the discussions which took place during the session. Table 29 summarizes the group discussions of different aspects of the films and the answers to the questions mentioned above.

Film	Issues	Relation to SynBio	Impressions
Reinventing the Dodo	• Nature as static and imperfect • Biodiversity, de-extinction, responsibility, human hubris	• Reconstructing organisms, genetic manipulation	• Biological reductionism. Reconstruction of the spirit and behaviour, impossible, responsibility for the creation -> Frankenstein tragedy •- Realistic? Is a synbio creature really so dependent? / not more dynamic, adaptable? • Nihilism • Moral norms can change • Nature ≠? Artificial creature • Value of nature • Cute, fictional topic
BioFlaneur	• Privacy, Panopticum (you can’t hide), DNA trace • Info overload	• There is no link?	• Loss of autonomy • Identity stealing • Knowing someone by DNA traces
Bioluminescent Streetlamps	• Lack of regulation + impossibility to control • Precautionary principle • We should challenge/address the users of the technology and maybe not the technology itself	• Limited technology: season bound, can’t turn it off	• Unfulfilled expectations • User creativity • Poetry/melancholic images • Acceptance based on emotions • Positive aspect, at the same time raises concerns why not working
Exploring Indonesia	• Not exploring, but exploiting -> unlimited possibilities • Simplistic symbols, depth of technology • “Start-up optimism”, marketing	• One-sided technology	• Serious or parody?
Copy and Clone	• Nature-human relation • Industrialized food production, antibiotics • Industrial cloning • Vulnerable/instable system (self-enforcing) • Narrow focus on economic efficiency	• Many issues present already • Digitization • Copyright on organisms/life forms (IP rights, access) • Big Business, capitalism	• Animal Welfare • Sad • Detachment from the “real world” • Trial+error • Game • Technophobic • Regulation?
Quanticare	• Privacy • Genetic code: your health? • Personalized healthcare • Old issue? • Now not the doctor, but technology • Individual scanning • Drug targeting • For whom will it work? • Access to data?	• Digitalization • New? • Your DNA = you? • Big biodata • Big Business, capitalism	• Cool • Personal identity • Control • Simplistic technocratic view • Aesthetic interactional relevance for broader public/ tattoo community -> aesthetic avant-gardism • Access to the treatment? • Regulation?

Table 29: Transcription of the results of brainstorming and group discussions of films

Issues raised in the films and participants' impressions

Participants could identify a wide range of issues handled in the films. Regarding the quantity of reactions, the three more critical films showed more response in the discussion, with the exception of "Quanticare". This might be due to the fact that the relation between "BioFlaneur" and synthetic biology was not recognized and "Exploring Indonesia" was seen as too simplistic.

With respect to the problematization of synthetic biology, most of the comments fit into one of the three categories discussed by Bogner and Torgersen. In addition, there was also a focus on applications which belongs to the economy frame but implicitly touches the mode of ethics as well.

"Reinventing the Dodo", "BioFlaneur" and to some extent "Copy and Clone" as well as "Quanticare" were discussed under the umbrella of the ethics mode. Human responsibility, hubris, the relation between the artificial and the natural as well as privacy and distribution issues were addressed.

"Bioluminiscent Streetlights" was framed in the "risk" mode of problematization and associated with a lack of regulation, the loss of control and the precaution principle.

The issue of economic impact was mainly addressed when discussing "Quanticare". This film with its positive representation of possible medical applications nevertheless earned many critical comments from the participants with respect to who will profit from such a technology and who will have access to the respective data.

The participants especially reacted to emotional aspects of the films such as the "cute" Dodo, the ambiguous comment in "Bioluminescent Streetlamps" and the over-positive stories of "Exploring Indonesia" and "Quanticare".

The general attitude towards synthetic biology in the discussion rounds can also be regarded as mainly critical because in addition to the issues raised by the critical films, negative associations were also found for the more neutral or positive clips.

This analysis of the material shall exemplify the practical use of the films as stimulus material and one possible categorisation of the issues. However, it is limited to the single event and the limited number of participants. It nevertheless illustrates the possibilities for applying the method to a larger and more diverse audience.

Films in public participation on STI issues

After discussing the screened films, the debate was taken to a more general level. The advantages and disadvantages of using films and this format of the session, its potential to contribute to reflections on the implications of synthetic biology and how it can be transferred to other environments and other contexts were discussed. First of all, it was pointed out that the topics handled in the selected films were relatively specific and more appropriate for someone who is already familiar with the subject and that it would be

difficult to engage a broader public with these topics. However, the format of the session could serve as a good entry point to open up a discussion and to reflect about developments in the field of synthetic biology, as it stimulates thinking and an exchange of different points of view. The films were appealing, as they represented visual information, which was easier to "digest" than long pieces of text. Several participants who were not familiar with the field of synthetic biology pointed out their difficulties to understand what the films were about, but during the group discussion, they were informed on the issues represented in the films by other members of the group. Thus, it is necessary to consider giving a short introduction on the field before showing the films. It is also important to put the films into context for a broader public, as one of the participants noted: "because if one of these clips would be a huge success and have billions of views on YouTube, on the one hand it would of course be amazing, but on the other hand, that would be a kind of, maybe a dominant thing as well in thinking of what synthetic biology might mean and that might be too narrow."

In other words, while films like these are considered to be great stimulus material for a broad discussion of the societal ramifications of synthetic biology, they are not supposed to completely replace other, more factual, sources of information.

Conclusions

The aim of the session was to use a selection of films, shown during the BIO·FICTION Film Festival, to stimulate a discussion and the reflection on the societal issues regarding synthetic biology. This paper is based on the results of the session and discussed how films can be applied to engage a broader public in questions regarding scientific and technological developments. This session was an attempt to experiment with public engagement formats in synthetic biology. In general, there was a positive feedback from participants for using the films in public engagement on science and technology development issues, as they represent an easy and appealing entry point to the topic. The number of societal issues mentioned and discussed is relatively similar to the issues discussed among social scientists, which means the films evoke a broad and encompassing reflection on the technology, in relatively short time. The films seem to work best for those who have at least a little bit of knowledge about synthetic biology. For someone unfamiliar with the field these films could be difficult to understand, which should be considered if the format is applied in activities aimed at a broader public. We conclude that the use of films can be very appealing for broader audiences.

References: Page 450

Visions of Technology Assessment

Approaches Used by DG JRC

Laurent Bontoux, Philip Boucher and Fabiana Scapolo

Abstract

The current economic sluggishness and the high level of unemployment in many European countries are creating political pressure to provide employment and re-industrialise Europe. This has created demand for the Joint Research Centre of the European Commission to develop new ways to generate intelligence that can both be used to support policies in favour of advanced manufacturing in the European Union and help industries develop long-term strategies to take advantage of these technologies. The approach that is being developed builds on results from previous foresight work and engages with experts connected to the specific industrial sectors that are investigated. The objective is to build a process for technology assessment that can be used across diverse industry sectors.

Current Policy Context

Against a background of continuing industrial decline throughout most Member States, industrial policy at European Union (EU) level has made a comeback, reversing decades of non-interventionism. Since 2010, it has been the object of no less than three European Commission Communications (European Commission 2010, 2012, and 2014a). The 2014 Communication called for an 'industrial renaissance' and a commitment to raise the share of industry in the European Gross Domestic Product (GDP) from 16% to 20% by 2020. Its key ideas were:

- Better regulation (competitiveness proofing in impact assessments, fitness checks);
- Relaxation of state aid rules;
- Creation of an EU internal market for goods and services;
- Minor reforms of the standardisation system;
- Cheap energy;
- Secure access to raw materials;
- Sensitiveness to the needs of energy-intensive industries and (low-tech) SMEs (COSME).

It also called for strengthening investment in six areas deemed strategic:

- Advanced manufacturing;
- Key enabling technologies (KETs);

- Bio-based products;
- Clean vehicles;
- Sustainable construction;
- Smart grids.

The arrival of a new Commission in 2014 did not fundamentally change the situation. President Juncker's ten priorities include "a new boost for jobs, growth and investment" (Priority 1) and "a deeper and fairer internal market with a strengthened industrial base" (Priority 4) (Juncker 2014). A recent addition to these early top level priorities is the initiative to prepare a more ambitious circular economy package with a clear objective to make industrial production more resource-efficient.

These recent policy priorities did not reduce the high interest for Advanced Manufacturing Technologies at EU level. The concept of "Industry 4.0" (BMBF 2012), developed in Germany with a clear aim of making better use of digital technologies in manufacturing, needs to be complemented by initiatives that are relevant for the whole European Union and for all enterprises and industry sectors. This is a tall order for EU policy making and calls for a pragmatic approach.

The Work of the JRC

In the face of these EU policy challenges, DG GROW (European Commission's Directorate General for Internal Market, Industry, Entrepreneurship, and SMEs) requested the support of the Directorate General Joint Research Centre of the European Commission (JRC) to develop ways of supporting EU manufacturing companies. The JRC, and in particular its Foresight and Behavioural Insights Unit, could offer support on the basis of five characteristics:

- Problem solving on specific policy issues;
- Process design/operation;
- Provision of forward-looking perspectives;
- Cross-cutting honest brokerage;
- On demand, co-design.

These five characteristics have been built on the basis of JRC's position in the Commission, experience in foresight, and technological understanding.

The JRC has long been the European Commission's in-house science service, used to working across EU policy silos, independently from national and private interests as well as from individual Commission services. Recent experiences in foresight include studies on food security (for DG DEVCO[1] – Directorate General for International Cooperation and Development), on diets and health (for DG RTD – Directorate General for Research and Innovation – with a follow-up for DG SANTE – Directorate General for Health and Food Safety (Bock et al. 2014)), on eco-industries (reflecting on transitions to a more sustainable economy – in print), and on industrial standards (for DG GROW (Scapolo et al. 2014)). These last two studies are particularly relevant for the understanding of the evolution of industrial production systems.

In addition, the JRC is developing the EU Policy Innovation Lab, a platform to create innovative policy development processes in an open, multidisciplinary environment. The EU Policy Innovation Lab is providing three complementary types of policy support services:

- Making sense of emerging trends and envisaging alternative futures;
- Better understanding of individuals and group behaviours;
- Design for policy: engaging, co-developing, prototyping and testing new solutions.

This combination of future oriented, behavioural, and co-design services provides a unique portfolio of services and shapes the EU Policy Innovation Lab distinctively compared to other initiatives in the public sector. Thanks to its unique ability to attract people, the lab makes intense use of external experts through participative techniques.

Current Challenges and Responses

The main challenges created by the context described above are a fast pace of change(s), new perspectives, the new agenda brought in by the new Commission and how to connect it to a complex reality and make sense of it.

As an organisation whose core function is to provide scientific advice to policy, the JRC has to address these challenges (Joint Research Centre, 2015). In order to remain relevant, the JRC must establish a dynamic link to the advice that it provides to the European Commission. Otherwise the advice could rapidly become obsolete. Considering the pace of change, it is also necessary to link forward-looking approaches and current policy demand. Finally, testing of the approaches and processes that are developed is very important to make sure that they are solid and resilient enough for EU policy making.

JRC Project on Advanced Manufacturing

The JRC project on advanced manufacturing currently performed in support of DG GROW is a prime example of the approach developed by the JRC. While it is not a classic technology assessment methodology, it contributes to deepening the understanding of technologies and their impacts. The main purposes of the project are:

- To develop a reusable process that can be repeated in time and across industry sectors;
- To help industry identify the main systemic technological challenges lying ahead on the way to achieving their long-term vision/objectives; and
- To help policy makers create the right policies to address them with a view to increase the sustainability and competitiveness of EU manufacturing.

Aligned with the need to be forward-looking, technology-oriented and policy-relevant, the project team decided to build on the foresight work that had been previously carried out. In particular, the JRC foresight study on industrial standards had developed a systemic vision of the European industrial production and consumption system called “Industrial Landscape Vision 2025” (ILV2025). This vision had been previously accepted as relevant by DG GROW (European Commission, 2014b). Therefore, for the new project on advanced manufacturing, it was decided:

- To apply the ILV2025to selected industry sectors in order to define sectorial long-term visions;
- To identify the most likely technology challenges created by these visions;
- To define the relevant technology roadmaps to achieve these visions; and
- To derive from these roadmaps and visions the specific policy challenges that are best addressed at EU level.

There are several advantages to using the ILV2025 as a lens through which to envision this work. First of all, it has been adopted by DG GROW, thereby facilitating both the understanding and the acceptability of the results by the main customer of the project. Secondly, it offers both a systemic perspective and a dynamic framework for the development of sectorial visions of the future of the EU industry. Thirdly, it is an industrial vision developed by the JRC, and therefore well understood by the project team.

Figure 33: A graphic description of the ILV2025 (Scapolo et al. 2014)

In addition, the ILV2025 offers a robust way to take into account major trends that have been recognised by many experts to affect European and global industries: customers’ desires for individualisation & personalisation, industry players’ engagement into regional customisation to better adapt to their markets, the increasing integration of ICT in manufacturing processes, big data, and a more agile production system in general. Figure 33 shows a graphic illustration of the ILV2025.

In order to maximise the chances of success and the usability of the project results both for EU policy making and for the industry sectors involved, the study process is being developed to be:

1. Transparent,
2. Inclusive and participative,
3. Technology-focussed,
4. Adaptable to diverse industry sectors,
5. Relevant for industry and policy making, and
6. Repeatable.

Conclusion

The current economic context characterised by low GDP growth, high levels of public debt, and a high level of unemployment in many European countries is creating political pressure to stimulate the EU economy. The chronically high levels of unemployment affecting several EU Member States following years of factory closures and offshoring are of particular concern. One policy objective to create employment is the idea that re-industrialising Europe would generate both new added value and new employment.

Within the European Commission, this has created demand for the JRC to develop new ways to generate intelligence that can both be used to support policies in favour of advanced manufacturing in the EU and help industries develop long-term strategies to take advantage of these technologies. The three main objectives pursued by the new JRC project on advanced manufacturing are:

- To develop a reusable process that can be repeated in time and across industry sectors;
- To help industry identify the main systemic technological challenges lying ahead on the way to achieving their long-term vision/objectives; and
- To help policy makers create the right policies to address them with a view to increase the sustainability and competitiveness of EU manufacturing.

The approach that is being developed builds on results from previous foresight work, especially the ILV2025, and engages with experts connected to the specific industrial sectors that are investigated. The objective is to build a process for technology assessment that can be used across diverse industry sectors, be transparent, inclusive and participative, technology-focussed, relevant for both industry and EU policy making, as well as repeatable.

References: Page 450

Afterword

Technology Assessment as Political Myth?

Roger Pielke, Jr.

Abstract

This short paper considers two topics of technology assessment in the context of political myth. The two subjects are the role of "basic research" in the innovation landscape and the so-called green revolution in agriculture. I argue that both examples exhibit properties of politic myth – the condensation of expectations of cause and effect into stories that we tell ourselves to justify commitments to one course of action or another. I argue that the making of wise decisions on innovation – in general or in a field such as agriculture – would benefit from opening up our political myths to scrutiny and, in some cases, challenging received wisdom.[1]

Introduction: The Meaning and Significance of "Political Myth"

Discourse is full of political symbols. Cobb and Elder (1983) define a symbol as: "any object used by human beings to index meanings that are not inherent in, nor discernible from, the object itself. Literally anything can be a symbol: a word or a phrase, a gesture or an event, a person, a place, or a thing. An object becomes a symbol when people endow it with meaning value or significance." Consequently, political symbols play an in important role in politics – bargaining, negotiation and compromise in pursuit of shared interests, and in policy – the securing of a commitment to a course of action (see Pielke, 2007).

Social science has a long tradition of research into the social and political context of collective action. Gunnell (1968) argued that one purpose of such research is "illuminating the symbolic context that gives meaning to social action."[2]

In political discourse symbols can be referential and/or condensational (Sapir 1934). Referential symbols are "economical devices for purposes of reference." So each of the following are examples of a referential symbol -- !, X, PIZZA, etc. The second type of symbol distinguished by Sapir holds "emotional tension in conscious or unconscious form." Examples of such symbols would include a swastika, the American flag, and your family name.

Sapir highlights the importance of symbols in human interactions: "society is peculiarly subject to the influence of symbols in such emotionally charged fields as religion and politics." Following Sapir, Lasswell et al. (1952) define "key political symbols" as those which occur "in the flow of political statements." They further distinguish three types of symbols:

- identification (referring to people and groups)
- demand (referring to preferences and volitions)
- expectation (referring to assumptions of fact)

Symbols play an important role in politics because they are used as instruments of power but also to expand and contract the scope of options for collective action (see, e.g., Brunner, 1987; Burnier, 1994).[3]

For instance, consider the technology of vaccination. As a technology, vaccination provides "something a policy cannot: a reliable cause-effect chain that delivers a particular local outcome with great consistency" (Sarewitz 2011). In this case the "local outcome" is protection against disease. But as a political symbol, vaccination is anything but viewed consistently. Consider the following two examples:

- After the CIA used a vaccination program in Pakistan as cover to gather intelligence on the whereabouts of Osama bin Laden, The Economist reported: "All over the world, poor people resist vaccination campaigns in the belief that they are part of a plot by powerful authorities to take advantage of them. The CIA operation in Pakistan turns these fears from crazy conspiracy theories into accurate and rational beliefs."[4]
- In 2013 an epidemic of measles occurred in Wales, 15 years after false claims about vaccination risks. The Wall Street Journal reported: "Many here refused the vaccine for their children after a British doctor, Andrew Wakefield, suggested it might cause autism and a local newspaper heavily covered the fears. Resistance continued even after the autism link was disproved."[5]

In these instances vaccination became more than just a technical process of inoculation against disease. It became, in the former instance, a symbol of western aggression and, in the latter, of great risks to children. In each case the symbolization reflects power and evocative patterns of identification, demand and expectation which resulted in changing patterns of power and decision making. The consequences in each case were profound, more cases of polio and measles. The effects of symbols in politics are very real.

Symbols are the building blocks of political myth. As Bottici and Challand (2006) explain, "[P]olitical myths are mapping devices through which we look at the world, feel about it and therefore also act within it as a social group." They continue:

- [P]olitical myths cannot be falsified because they are not scientific hypotheses as to the constitution of the world or astrological almanacs that foretell its future: they are determinations to act that can always reinforce themselves. This practical dimension of a political myth cannot, however, be separated from what we can call its cognitive and its aesthetic dimension. Political myths provide fundamental cognitive schemata for the mapping of the social world: by reducing the complexity of experience, they enable us to come to terms with the multifaceted character of the world we live in.

In what follows I summarize explorations of two powerful symbols found in the field of technology assessment, namely basic research and the green revolution, as political myths, that is, as a mapping device through which we look at the world, interpret ît, and shape how we act in it. These two are chosen merely as examples of the role and power of political myth in shaping both discourse and action. The goal of this exploration is not to falsify a political myth, but rather to evaluate it and its components in terms of how it shapes thinking and action. Our explorations of technology assessment may be more informed with a willingness to recognize and challenge a political myth.

Basic Research as Political Myth

Writing in the Washington Post, a member of the US Congress and the president of the American Association for the Advancement of Science argued that: "Across society, we don't have to look far for examples of basic research that paid off."[6] They cite the creation of Google as a prime example of such payoffs: "Larry Page and Sergey Brin, then a National Science Foundation [NSF] fellow, did not intend to invent the Google search engine. Originally, they were intrigued by a mathematical challenge...."[7]

The appealing imagery of a scientist who simply follows his curiosity and then makes a discovery with a large societal payoff is part of the core mythology of post-World War II science policies. The mythology shapes how governments around the world organize, account for, and fund research. A large body of scholarship has critiqued postwar science policies and found that, despite many notable successes, the science policies that may have made sense in the middle of the last century may need updating in the 21st century.

In short, investments in "basic research" are not enough. Benoit Godin has asserted that: "The problem is that the academic lobby has successfully claimed a monopoly on the creation of new knowledge, and that policy makers have been persuaded to confuse the necessary with the sufficient condition that investment in basic research would by itself necessarily lead to successful applications."[8] Or as Leshner and Cooper declare in The Washington Post: "Federal investments in R&D have fueled half of the nation's economic growth since World War II."

A closer look at the actual history of Google reveals how history becomes mythology.[9] The 1994 NSF project that funded the scientific work underpinning the search engine that became Google (as we know it today) was conducted from the start with commercialization in mind: "The technology developed in this project will provide the 'glue' that will make this worldwide collection usable as a unified entity, in a scalable and economically viable fashion."[10] In this case, the scientist following his curiosity had at least one eye simultaneously on commercialization.

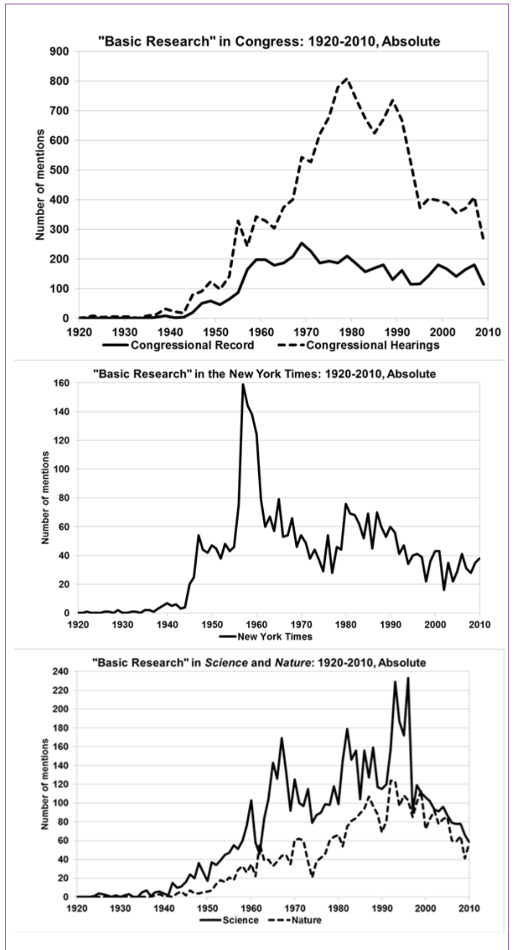


Figure 34: Basic Research

The phrase "basic research" originated around 1920 in the United States' agricultural community, where "research" was described as "the basic work" of the Department of Agriculture. The phrase was shortened to simply "basic research" and its usage slowly expanded in the 1920s and 1930s, but without the meaning it carries today. Ironically, basic research began as a phrase meaning what today we call applied research.

During the period between the World Wars, scientists in both the US and UK sought to expand their role in government, as well as government's role in supporting science – in both instances with limited effect. During this time, scientists continued to appeal for government support of "fundamental" or "pure" research conducted with little or no consideration of its application. On both sides of the Atlantic such arguments, not surprisingly, found little political support.

Not until World War II did governments decide that large-scale support of scientific research was an appropriate role for public investment. As has been well chronicled, the change in orientation was reflected in Vannevar Bush's Science – The Endless Frontier, which marked the transformation of "basic research" into a political symbol representing a powerful conception of the role of science in society.[11]

Bush's decision to use the phrase was conscious and strategic, as he explained in his memoirs: "To persuade the Congress of the pragmatically inclined United States to establish a strong organization to support fundamental research would seem to be one of the minor miracles ... When talking matters over with some of these [people on Capitol Hill], it was well to avoid the word fundamental and to use basic instead."

After the war, the usage of the phrase "basic research" increased dramatically in the elite media, in Congress, and within the scientific community. Interestingly, the usage increased and peaked first in the media, next in Congress, and lastly within the scientific community

– a pattern supporting Bush's claim that the phrase was politically expedient. Yet, despite its fall from favor, it remains a core concept in contemporary discussions of science policy.

A key reason for the durability of the phrase is that it can simultaneously convey opposite meanings to different audiences. For many scientists, "basic research" means "fundamental" or "pure" research conducted without consideration of practical applications. At the same time, policy makers see "basic research" as that which leads to societal benefits including economic growth and jobs.

In recent decades, use of the phrase "basic research" has been in decline. The scientific community has tried out an impressive range of alternative phraseology – "fundamental," "transformative," "transformational." Academics have also provided suggestions – "use-inspired," "collaboratively assured," and "mode 2." To date, no key symbol has displaced basic research for the simple reason that no model of science policy has yet displaced the postwar consensus. If and when such a shift occurs, it will not only be our institutions that change but our language as well.

The Green Revolution as Political Myth

The phrase "green revolution" was coined in 1968 to describe the recent and anticipated rapid increase in agricultural productivity through the adoption of new technologies, such as new hybrid varieties that thrived with a surging use of fertilizers, irrigation, and pesticides. The green revolution is used to refer to both an event and a process.

As an event, the green revolution is primarily associated with rapid increases in Indian wheat production in the late 1960s. As a process, the green revolution is commonly attributed to the period 1940 to 1970, starting with the planting of modern crop varieties in Mexico. A Google search for "Green Revolution in India" gave 507,000 hits, fourteen times more common than "Green Revolution in Mexico", which shows up 36 700 times. The same search terms for other countries give even fewer hits.[12]

Agricultural development predated and lasted longer than the period encompassed by the green revolution under either definition.[13] The so-called developing world in total saw food production more than double between 1960 and 1985.[14] By the 1990s, almost three-quarters of Asia's rice production and half of the wheat in Asia, Latin America and Africa was produced through new plant varieties.[15] While Asia's net cropped area only increased 4% in 25 years, the food supply was doubled. In four decades after 1950, global cereal production had increased by 174% while the global population increased by 110%.[16]

The enormous increase in global food production was the result of agricultural change over more than 100 years. To understand how and why it was conceptualized as a revolution, we need to look not only at the development of agriculture in the early post-World War II years, but also at the connection between the global population debate, natural resources management, geo-politics and the emergence of a powerful scientific elite.

As a political myth, the green revolution has come to represent actions which saved the world from massive starvation. In May, 2014 The Economist repeated the oft-told story:

- The first green revolution helped save the developing world from disaster. Two plant breeders, Norman Borlaug with wheat and M.S. Swaminathan with rice, persuaded governments in Asia and elsewhere to encourage the planting of higher-yielding varieties, especially of rice; 3.5 billion people, half of mankind, get a fifth of their calories or more from the stuff. When the men started work in the early 1960s, China was suffering the famine of the Great Leap Forward. And India was widely thought to be on the brink of starvation.[17]

A more accurate history shows that the specter of a looming famine in India was an invention engineered by President Lyndon Johnson to help sustain the U.S. Food for Peace program, which faced a politically skeptical Congress. Technological advances had led to a glut of crops in the U.S., low prices for commodities, and unhappy farmers. Agricultural aid was also seen as a useful strategy in the Cold War. So Johnson wanted the shipments made. Thus, as historian Nick Cullather writes in The Hungry World, "through the fall of 1965 [LBJ] developed the theme of a world food crisis brought on by runaway population growth."

In fact, official State Department notes reveal that when Indian prime minister Indira Gandhi visited Washington in the spring of 1966, one of her agenda items was to get the story straight about a crisis that didn't exist. The Indian delegation noted that, "The situation in the United States is that to get a response, the need must be somewhat overplayed." Scientists and the media jumped on the bandwagon, and a mythology of famine was born.

Bailey's restatement of the Green Revolution mythology in fact gives neo-Malthusians far too much credit, suggesting that they were correct in their forecast of global famine, only to be proven wrong by the wonders of technological and market innovation. In fact, the neo-Malthusians were never right to begin with. Bailey is promoting a solution to a problem that never existed in the first place.

In 2003, the International Food Policy Research Institute asked what would have happened if the Green Revolution in the developing world never happened. They concluded that developed countries would have produced more and trade patterns would have evolved differently, but the situation "probably would not be considered a 'World Food Crisis.'"

As with all myths, there are elements of fact and fiction at work. Scientific investments did indeed contribute to increasing crop yields in India and elsewhere. But the notion of a world on the brink of famine was a political creation, motivated by the confluence of US Cold War politics (both domestic and international), the rise of neo-Malthusians, and a growing scientific community hungry for power and influence.

Conclusion

This talk and brief overview paper argue that the narratives which we construct around science and technology in the broad field of technology assessment exert a powerful influence on how we think and act. Science and technologies are, in addition to knowledge and tools, powerful political symbols. Such symbols, when deeply ingrained into culture and society, have been called "political myths."

The notion of basic research has been part of the discourse in science policy for almost a century. It encapsulates an axiology – a theory of value, along with a theory of causality, ultimately linking public investments in science with broad societal goals such as economic growth. Both the value structure and mechanisms of causality underpinning the notion of basic research have been challenged in recent decades, but thus far no new political mythology has displaced that of basic research.

Similarly, the mythology of the green revolution exerts a strong influence not just on agricultural policies, but on innovation policies more generally. That influence can be readily seen in calls for a "Second Green Revolution," which suggests that the world needs to replicate the first. However, a close look at the history of the green revolution suggests that the world experienced more of a green evolution.

Understanding how policy alternatives are connected to possible outcomes is essential to effective decision making. Political myths can often facilitate effective decision making, but can also stand in the way. Understanding the difference is essential to effective science and technology policy making, and thus understanding, critiquing and even re-inventing political myths should be a core task of the discipline that we know as technology assessment.

References: Page 451

References

Introduction, p. 11.

Michalek, T., Hebáková, L., Hennen, L., Scherz, C., Nierling , L., Hahn, J. (eds.), 2014: Technology Assessment and Policy Areas of Great Transitions. Proceedings from the PACITA 2013 Conference in Prague. Prague 2014

Hennen, L., Nierling, L., 2015: A next wave of Technology Assessment? Barriers and opportunities for establishing TA in seven European countries. Science and Public Policy 42 (2015) 1, 44-58

PART I – Technology Assessment and Policy Making

The Role of Research Evidence in Improving Parliamentary Democracy, p. 19.

Blankesteijn, M.; Munnichs, G.; Van Drooge, L., 2014: Contested science - Public controversies about science and policy. Rathenau Instituut. The Hague

Bütschi, D.; Almeida, M., 2015: Technology assessment for Parliaments: towards reflexive governance of innovation. In: Klüver, L., Øjvind Nielsen, R. & Jørgensen, M. (eds.): Policy-Oriented Technology Assessment Across Europe. Palgrave. London

Bütschi, D., 2012: Knowledge-based policy making. Report of the 1st Parl. TA Debate held in Copenhagen on June 18, 2012. TA-SWISS. Berne

Goodwin, M., 2014: Political science? Does scientific training predict UK MPs voting behaviour? Parliamentary Affairs, 68(2): 371-392

Gough, D.; Tripney, J.; Kenny, C.; Buk-Berge, E., 2011: Evidence Informed Policy in Education in Europe: EIPEE final project report. EPPI-Centre, Social Science Research Unit, Institute of Education, University of London. London

Graham, I. D.; Logan, J.; Harrison, M. B.; Straus, S. E.; Tetroe, J.; Caswell, W.; Robinson, N., 2006: Lost in knowledge translation: time for a map? Journal of continuing education in the health professions, 26, 13-24

Guston, D. H.; Sarewitz, D., 2002: Real-time technology assessment. Technology in Society, 24, 93-109

Henderson, M., 2011. The Geek Manifesto: Why science matters. Corgi. Kibdib

Hennen, L.; Nierling, L., (eds.), 2015: TA as an institutionalized practice: Recent national developments and challenges. European Union. Brussels

Maynard, O.; Evans-Reeves, K., 2015: Flower shows and festivals: tobacco industry hospitality and MP voting. Guardian, 16 March

Nath, C., 2011: Use of scientific and technological evidence within the Parliament of Uganda. Parliamentary Office of Science and Technology; The Parliament of Uganda; The Ugandan National Academy of Sciences

Nutley, S.; Walter, I.; Davies, H., 2007: Using evidence: how research can inform public services. Policy Press. Bristol

Oakley, A., 2000: Experiments in knowing: gender and method in the social sciences. Polity Press. Cambridge

OECD., 2015: Scientific advice for policy making: The role and responsibility of scientists. OECD. Paris

Padilla, A.; Gibson, I., 2000: Science moves to centre stage. Nature. 403, pp. 357-359

Pautz, H., 2014: British Think-Tanks and Their Collaborative and Communicative Networks. Politics. 34/4 (2014), pp. 345-361

Scott, S.; Knapp, M.; Henderson, J.; Maughan, B., 2001: Financial cost of social exclusion: follow up study of antisocial children into adulthood. BMJ : British Medical Journal 323/7306 (2001), pp. 191

Sebba, J., 2011: How do research mediators, including think tanks, enhance or inhibit social science knowledge transfer: a review of research. KT Social Care Seminar, 10 February, London School of Economics and Political Science

Sebba, J., 2013: An exploratory review of the role of research mediators in social science. Evidence & Policy: A Journal of Research, Debate and Practice 9/3 (2013), pp. 391-408

Shaxson, L.; Bielak, A.; Ahmed, I.; Brien, D.; Conant, B.; Fisher, C.; Gwyn, E.; Klerkx, L.; Middleton, A.; Morton, S.; Pant, L.; Phipps, D., 2013: Expanding our understanding of K* (KT, KE, KTT, KMb, KB, KM, etc). A concept paper emerging from the K* conference held in Hamilton, Ontario, Canada, April 2012. Institute for Water, Environment and Health, United Nations University. Hamilton, Canada

Smith, K. E.; Kay, L.; Torres, J., 2013: Think tanks as research mediators? Case studies from public health. In: Evidence & Policy: A Journal of Research, Debate and Practice, 9/3 (2013), pp. 371-390

Spruijt, P.; Knol, A. B.; Vasileiadou, E.; Devilee, J.; Lebret, E.; Petersen, A. C., 2014: Roles of scientists as policy advisers on complex issues: A literature review. In: Environmental Science & Policy, 40/1 (2014), pp. 16-25

Stone, D., 2007: Recycling bins, garbage cans or think tanks? Three myths regarding policy analysis institutes. In: Public Administration 85/2 (2007), pp. 259-278

Tiemeijer, W.; de Jonge, J., 2013: Hoeveel vertrouwen hebben Nederlanders in wetenschap? Wetenschappelijke Raad voor het Regeringsbeleid and Rathenau Instituut. The Hague

Tyler, C., 2013: Scientific advice in Parliament. In: Doubleday, R.; Wilsdon, J. (eds.) Future directions for scientific advice in Whitehall. University of Cambridge's Centre for Science and Policy; Science Policy Research Unit (SPRU) and ESRC STEPS Centre at the University of Sussex; Alliance for Useful Evidence; Institute for Government; Sciencewise-ERC. London, pp. 115-120

Weiss, C., 1979: The many meanings of research utilisation. Public Administration Review 39/5 (1979), pp. 426-431

Williamson, B., 2014: Knowing public services: Cross-sector intermediaries and algorithmic governance in public sector reform. In: Public Policy and Administration 29/4 (2014), pp. 292-312

Technology Assessment and Parliaments, p. 23.

Bütschi, Danielle (2012). Knowledge-based policy making. Report of the First Parliamentary TA Debate, held in Copenhagen on June 18 2012, Berne: TA-SWISS

Cruz-Castro, Laura and Sanz-Menéndez, Luis (2005). Politics and Institutions: European Parliamentary Technology Assessment. In: Technological Forecasting & Social Change 72 (2005), pp. 429–448

Bütschi, Danielle (2014). Strengthening Technology Assessment for Policy-Making Report of the Second Parliamentary TA Debate held in Lisbon on 7-8 April 2014. Berne: TA-SWISS

Grunwald, Armin (2011). "Responsible Innovation: Bringing together Technology Assessment, Applied Ethics and STS research", Enterprise and Work Innovation Studies, 7, IET, pp. 9 - 31

Gudowski, Niklas, et al. (2014). Responsible Research und TA – Innovationen neu gestalten. Bericht der 6. Konferenz des Netzwerks TA und der 14. Jahreskonferenz des ITA Wien, Vienna: ITA

Von Schomberg, René (2012). Prospects for Technology Assessment in a framework of Responsible Research and Innovation", in: Marc Dusseldorp and Richard Beecroft (Hrsg.) Technikfolgen abschätzen lehren. Bildungspotenziale transdisziplinärer Methoden, Wiesbaden: Springer

Von Schomberg, René (2013). "A vision of responsible innovation". In: Richard Owen, John Bessant and Maggy Heintz (eds.) Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society, Chichester, UK: John Wiley & Sons

Footnotes:

1) A first debate, held at the Danish parliament in June 2012, was dedicated to the general issue of knowledge-based policy-making (Bütschi 2012). A second debate took place at the Portuguese parliament in April 2014 and explored the role and use of TA in national and European policy-making processes (Bütschi 2014).

Interactive Development of Indicators for Responsible Research and Innovation, p. 27.

Curry, Dion, Trends for the future of public sector reform: a critical review of future looking research in public administration, COCOPS project (Coordinating for Cohesion in the Public Sector of the Future), www.cocops.eu, April 2014

Gibbons, M., C. Limoges, H. Nowotny, S. Schwartzman, P. Scott and M. Trow, The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies. (1994), London, Sage

Indicators for Promoting and Monitoring Responsible Research and Innovation, Report from the Expert Group on Policy Indicators for Responsible Research and Innovation, (Chair: Roger Strand, Rapporteur: Jack Spaapen, Members: Martin W. Bauer, Ela Hogan, Gema Revuelta, Sigrid Stagl, Brussels, DG R&I, EUR 26866 EN, June 2015

Nowotny, Helga, Peter Scott and Michael T. Gibbons, Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty, (2001), London, Wiley

Owen, Richard, Phil Macnaghten and Jack Stilgoe, Responsible research and innovation: From science in society to science for society, with society, Science and Public Policy, 39, 2012, pp. 751-760

Schomberg, R. von, (2011), 'Prospects for Technology Assessment in a framework of responsible research and innovation', in Technikfolgen abschätzen lehren: Bildungspotenziale transdisziplinärer Methode, Springer VS, Wiesbaden

Spaapen, Jack, and Leonie van Drooge, Introducing 'productive interactions' in social impact assessment, Research Evaluation, 20(3), September 2011, pages 211–218

Wickson, Fern and Anna L. Carew, Quality criteria and indicators for responsible research and innovation: learning from transdisciplinarity, Journal of responsible research and innovation, published online 8 October 2014

Footnotes:

1) In this top sector policy, the government indicated nine economic sectors that are important for the Dutch economy. The idea is that in these sectors, collaborative arrangements are funded between scientific research, industry, and/or societal organisations. See: http://topsectoren.nl/english

2) See for example Owen, Macnaghten and Stilgoe2012: 751

3) Letter of the Government to the parliament of 28 January 2015, Minbuza-2015.25600, the Hague.

4) Indicators for Promoting and Monitoring Responsible Research and Innovation, Report from the Expert Group on Policy Indicators for Responsible Research and Innovation, (Chair: Roger Strand, Rapporteur: Jack Spaapen, Members: Martin W. Bauer, Ela Hogan, Gema Revuelta, Sigrid Stagl, Brussels, DG R&I, EUR 26866 EN, June 2015.

5) An interesting example, though, of new quality criteria for RRI can be found in Wickson and Carew (2014) who start from a transdisciplinary perspective and develop a qualitative assessment framework along the lines of seven characteristics of RRI, such as social relevance, sustainability, reflexiveness, and accountability.

6) Examples from the Netherlands regard the top sector policy, in which for each of the nine sectors so-called TKI's are established (Top consortium for Knowledge and Innovation), where entrepreneurs and scientists together develop innovative products or services; and so-called economic boards that some cities have established in which partners from different institutional backgrounds (universities, professional schools, employers, policy makers) discuss innovation in the city and wider region.

7) In the EU project COCOPS, the growing prominence of other stakeholders (than the government) is identified as a cause for less hierarchical forms of governance in public sector activities (2014: p. 13 and further).

8) For SIAMPI see Spaapen and Van Drooge 2011; see for another example: http://www.rathenau.nl/en/themes/theme/project/eric-evaluating-research-in-context.html.

Indicators in Technology Assessment. Passive Choices or Reflected Options?, p. 33.

Barré, R., 2001: Agora processes - The Agora model of innovation systems: S&T indicators for a democratic knowledge society. Research Evaluation, 10(1), pp.13–18

Barré, R., 2004: S&T Indicators for policy making in a changing science-society: The New Science–Society Relationship. In: H. Moed, W. Glänzel, & U. Schmoch, eds. Handbook of Quantitative Science and Technology Research. Springer Netherlands, pp. 115–131

Böschen, S., 2014: Opening the Black Box: Scientific Expertise and Democratic Culture. In T. Michalek et al., eds. Technology Assessment and Policy Areas of Great Transitions. Prague: Technology Centre ASCR, pp. 37–47

Dahler-Larsen, P., 2013: Constitutive Effects of Performance Indicators. Public Management Review, (April), pp.1–18. Available at: http://www.tandfonline.com/doi/abs/10.1080/14719037.2013.770058 [Accessed May 6, 2013]

Demortain, D., 2011: Scientists and the Regulation of Risk. Standardising Control. Cheltenham: Edward Elgar

Ecomodernism.org, 2015: An Ecomodernist Manifesto. Available at: http://static1.squarespace.com/static/5515d9f9e4b04d5c3198b7bb/t/552d37bbe4b07a7dd69fcdbb/1429026747046/An+Ecomodernist+Manifesto.pdf [Accessed May 15, 2015]

Feller-Länzlinger, R. et al., 2010: All sized up - Counting, calculating and controlling in the knowledge-based society, Bern: TA-SWISS. Available at: http://www.ta-swiss.ch/en/projects/social-and-cultural-ta/indicators/

Freeman, C., 1995; The "National System of Innovation" in historical perspective. Cambridge Journal of Economics, 19(1), pp. 5–24. Available at: http://cje.oxfordjournals.org/content/19/1/5.short [Accessed November 14, 2013]

Garrelts, H., Flitner, M., 2011: Governance issues in the Ecosystem Approach: what lessons from the Forest Stewardship Council? Eur J Forest Res 130, pp. 305-405

Godin, B., 2008: The Knowledge Economy: Fritz Machlup's Construction of a Synthetic Concept, Montréal: Institut national de la recherche scientifique - Centre Urbanisation Culture Société

Gloede, F., 1992: Rationalisierung oder reflexive Verwissenschaftlichung? Zur Debatte um die Funktionen von Technikfolgen-Abschätzung für Technikpolitik. In: Petermann, Th. (Hrsg.): Technikfolgen-Abschätzung als Technikforschung und Politikberatung. Frankfurt: Campus 1992, S. 299-328 (Veröffentlichungen der Abteilung für Angewandte Systemanalyse (AFAS), Bd. 1)

Grupp, H. & Mogee, M.E., 2004: Indicators for national science and technology policy: how robust are composite indicators? H. F. M. et Al., ed. Research Policy, 33(9), pp.1373–1384. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0048733304001180

Grupp, H. & Schubert, T., 2010: Review and new evidence on composite innovation indicators for evaluating national performance. Research Policy, 39(1), pp.67–78. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0048733309001991 [Accessed June 10, 2011]

Heink, U. & Kowarik, I., 2010: What are indicators? On the definition of indicators in ecology and environmental planning. Ecological Indicators, 10(3), pp.584–593. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1470160X09001575 [Accessed March 5, 2013]

Kuhlmann, S., 2003: Evaluation of research and innovation policies: a discussion of trends with examples from Germany. International Journal of Technology Management, 26(2/3/4), p.131

Leimbach, T. et al., 2014: Potential and Impacts of Cloud Computing Services and Social Network Websites, Brussels: European Parliament Research Service

Merry, S.E., 2011: Measuring the World Indicators, Human Rights, and Global Governance. Current Anthropology, 52(S3), pp.S83–S95. Available at: http://www.jstor.org/stable/info/10.1086/657241 [Accessed November 3, 2012]

Nardo, M. et al., 2008: Handbook on Constructing Composite Indicators: Methodology and User Guide OECD & J. E. Commission, eds., Paris: OECD Publishing. Available at: http://www.oecd-ilibrary.org/oecd/content/book/9789264043466-en

Petersen, A.C., 2012: Simulating Nature. A Philosophical Study of Computer-Simulation Uncertainties and Their Role in Climte Science and Policy Advice. Boca Raton: CRC Press

Proctor, R.N.; Schiebinger, L. (eds.), 2008: Agnotoloy. The Making und Unmaking of Ignorance. Stanford: Stanford UP

Reber, B., 2006: Technology Assessment as Policy Analysis: From Expert Advice to Participatory Approaches. In F. Fischer, G. J. Miller, & M. S. Sidney, eds. Handbook of Public Policy Analysis - Theory, Politics, and Methods. Boca Raton, USA: Taylor & Francis Group, pp. 493–511

Torgersen, H., 2009: Synthetic Biology in Society: learning from past experience? Systems and Synthetic Biology 3, pp. 9-17

Footnotes:

1) The author was supported by a PhD scholarship from the Portuguese Fundação para a Ciência e Tecnologia (Ref. SFRH/BD/76200/2011).

2) Under the provisions of the Stability and Growth Pact, Members-states agreed to respect targets for two indicators: a deficit-to-Gross Domestic Product ratio of 3% and a debt-to-Gross Domestic Product ratio of 60%, in order to avoid excessive budgetary deficits. See http://ec.europa.eu/economy_finance/economic_governance/sgp/deficit/index_en.htm.

Integrity as an Indicator in Technology Assessment, p. 41.

Footnotes:

1) 2015: "Cheng als das stimmige Ganze der Integrität. Ein Interpretationsvorschlag zur Ethik". In: Auf Augenhöhe. Festschrift zum 65. Geburtstag von Heiner Roetz. Edited by Wolfgang Behr, Licia Di Giacinto, Ole Döring, Christine Moll-Murata; Bochumer Jahrbuch für Ostasienforschung, Vol. 38; Ludicium Verlag (Munich) 2015: pp. 39-62

2) Heiner Roetz: Konfuzius. 3rd edn. Munich: Beck 2006: p. 8

3) Cf. Tu Wei-Ming: "My interpretation of the Chung-yung consequently is no more than a reenactment of an age-long Confucian ritual", Tu 1989: 3; this hermetic notion makes it philosophically inaccessible. Don Munro claims that: "ch'eng referred to the unwavering attempt to realise the specific social virtues. From other passages in the texts we know that all these actually involved conforming with li. Ch'eng was then read into nature" (Munro 2001: 33f.), thus contradicting the rational dimension of social virtues.

I have provided a detailed account of this reconstruction and argument in my essay, entitled in German, "Cheng als das stimmige Ganze der Integrität. Ein Interpretationsvorschlag zur Ethik" ("Cheng as the Coherent Continuum of Integrity. A proposal for Ethics"), 2015.

4) E.g., cf. Li Ruiquan (Lee Shui-chuen) (1999): Rujia shengming lunlixue (Confucian Bioethics). Taipei: Ehu

5) "Shengren" can be translated as "holy person" or "accomplished person".

6) MR Macleod, et.al. (2014): Biomedical research: increasing value, reducing waste, The Lancet, January 8: 101-104: 103. Cf., I Chalmers et.al. (2014): How to increase value and reduce waste when research priorities are set; The Lancet 383: 156 – 165. In medical ethics; literature has just focused on the related medical research ethics. Issues, such as: Stella Elaine Urban 2015: Forschungsbetrug in der Medizin. Fakten, Analysen, Präventionsstrategien; Campus (Frankfurt/M).

7) David Cyranoski & Sara Reardon: "Chinese scientists genetically modify human embryos"; Nature News, April 22, 2015. Puping Liang, Yanwen Xu, Xiya Zhang, Chenhui Ding, Rui Huang, Zhen Zhang, Jie Lu, Xiaowei Xie, Yuxi Chen, Yujing Li, Ying Sun, Yaofu Bai, Zhou Songyang, Wenbin Ma, Canquan Zhou and Junjiu Huang (2015): "CRISPR/Cas9-mediated gene editing in human tripronuclear zygotes"; Protein & Cell 2015 6:153; cf.: http://link.springer.com/article/10.1007/s13238-015-0153-5/fulltext.html

8) Ole Döring 2014: Assessing Ethics in an Emerging Bio-Technology Field. The Cases of Medical Stem-Cell Research and Genetic Screening in China"; In: Michalek, T. et al. (eds), Technology Assessment and Policy Areas of Great Transitions; Prague 2014: 329-336.

The Art of the Long View. Reflections on a Future of RRI, p. 49.

Albrecht, Stephan 2006: Freiheit, Kontrolle und Verantwortlichkeit in der Gesellschaft. Moderne Biotechnologie als Lehrstück. [Freedom, Regulation and Responsibility. A Lesson from Modern Biotechnology] Hamburg: Hamburg University Press

Bongert, Elisabeth & Stephan Albrecht 2014: Staatliche Forschungsstrukturen, TA und transdisziplinäre Nachhaltigkeitswissenschaften. Auf dem Weg zu einer Symbiose? [Public Research, TA and Transdisciplinary Sustainability Science. Heading for Symbiosis?] In: Decker, M. et al. (eds), pp. 151-162

Carson, Rachel 1962: Silent Spring. Boston: Houghton Mifflin

Clark, W., P. Crutzen & J. Schellnhuber 2004: Sustainability Science. Boston: Harvard Univ., cf. http://www.hks.harvard.edu/centers/mrcbg/programs/sustsci

Decker, M. et al. (eds) 2014: Technikfolgenabschätzung im politischen System. Zwischen Konflikt Bewältigung und Technologiegestaltung. Berlin: edition sigma

Gardner, Dan 2011: Future Babble. Why Expert Predictions are Next to Worthless, and you can do Better. New York: Dutton

Jones, Tara 1988: Corporate Killing. Bhopals will happen. London: Free Association Books

Oreskes, Naomi & Erik M. Conway 2010: Merchants of Doubt. New York: Bloomsbury

Ott, Konrad 2014: Institutionalizing Strong Sustainability: A Rawlsian Perspective. Sustainability 2014, 6, 894-912; doi:10.3390/su6020894

Owen, R., M. Heintz, J. Bessant (Eds.) 2013: Responsible Innovation. Chichester: John Wiley

Schwartz, Peter 1991: The Art of the Long View. Planning for the Future in an Uncertain World. New York: Currency Doubleday

von Schomberg, René 2013: A vision of Responsible Research and Innovation. In: Owen, Heintz & Bessant (Eds.), pp. 51-74

UN 1992: United Nations Conference on Environment & Development. Agenda 21, cf. https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf

WBGU [German Advisory Council on Global Change] 2011: World in Transition. A Social Contract for Sustainability. Berlin: WBGU

Footnotes:

1) Referring to Peter Schwartz 1991.

2) Named after the famous book by Rachel Carson 1962, which analyzed the impact of synthetic chemicals for birds and other living organisms.

3) Where toxic gases from a Union Carbide Corporation chemical plant killed immediately up to 10,000 people. The long-term death toll amounts to more than 100,000 human beings (cf. Jones 1988).

RRI and the Dynamics of Markets. Global Objectives Require Global Approaches, p. 53.

Blok, Vincent, and Pieter Lemmens. “The emerging concept of responsible innovation. Three reasons why it is questionable and calls for a radical transformation of the concept of innovation.” Responsible Innovation 2. Springer International Publishing, 2015, pp. 19-35

Burtraw, Dallas: Innovation Under the Tradable Sulfur Dioxide Emission Permits Program in the U.S. Electricity Sector. Washington 2000. http://www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=17101

Grunwald, Armin: Responsible Innovation: Bringing together Technology Assessment, Applied Ethics, and STS research, Enterprise and Work Innovation Studies, 7, IET, 2011, pp. 9 - 31

Stilgoe, Jack, Richard Owen, and Phil Macnaghten: Developing a framework for responsible innovation. In: Research Policy 42, 9, 2013: 1568-1580

Von Schomberg, Rene: Der rationale Umgang mit Unsicherheit. Die Bewältigung von Gefahren und Dissens in Wissenschaft, Wissenschaftspolitik und Gesellschaft, Frankfurt am Main: Peter Lang Verlag, 1995

Von Schomberg, Rene: A vision of responsible innovation. In: R. Owen, M. Heintz and J Bessant (eds.): Responsible Innovation. London 2013: John Wiley, pp. 51-74

Weber, Arnd: Incentives for Reducing Global Fossil Fuel Combustion: Something to Look Forward to. Presentation given at “Energy Systems in Transition”, Karlsruhe 2013. http://www.itas.kit.edu/pub/v/2013/webe13b.pdf

Navigating Towards RRI. Challenges for Policy and Governance, p. 57.

BBSRC, EPSRC, & Sciencewise. (2010). Synthetic Biology Dialogue. Retrieved from http://www.bbsrc.ac.uk/engagement/dialogue/activities/synthetic-biology/

EC. (2009). A code of conduct for responsible nanosciences and nanotechnologies research. Retrieved from http://ec.europa.eu/research/science-society/document_library/pdf_06/nanocode-apr09_en.pdf

Lund Declaration. (2009). The Lund Declaration: Europe must focus on the grand challenges of our time. Retrieved from http://www.vr.se/download/18.7dac901212646d84fd38000336/

Meadows, D. H., Meadows, D. L., Randers, J., & Bahrens III, W. W. (1972). Limits to Growth. Universe Books

Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. Research Policy, 42(9), 1568–1580. http://doi.org/10.1016/j.respol.2013.05.008

WBCSD. (2010). Vision 2050: The new agenda for business. Retrieved from http://www.wbcsd.org/vision2050.aspx

Footnotes:

1) Res-AGorA (Responsible Research and Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-normative Approach) is an EU-funded (FP7) project with the aim to develop a comprehensive governance framework for Responsible Research and Innovation. For more details: www.res-agora.eu

2) The Lund Declaration (2009), which was adopted by the EU member states during the Swedish presidency of the European Council in July 2009, states that Europe must focus on contemporary grand challenges such as climate change, ageing societies and security.

3) Horizon 2020 is the EU Framework Programme for Research and Innovation covering the period of 2014-2020.

Responsibility as Care for Research and Innovation, p. 63.

Gilligan C. 1982: In a Different Voice - Psychological Theory & Women’s Development, Harvard University Press

Grinbaum, A.; Groves C., 2013: What is the ‘responsible’ in responsible innovation? Understanding the Ethical Issues. In: Owen, R.; Heintz, M.; Bessant, J. (eds.): pp. 119-142

Groves, C., 2009: Future ethics: risk, care and non-reciprocal responsibility. Journal of Global Ethics, 5/1, pp. 17-31

Hamington M.; Sander-Staudt M. (eds.), 2011: Care ethics and Business Ethics. Dordrecht: Springer.

Owen, R.; Macnaghten P.; Stilgoe J., 2012: Responsible research and innovation: from science in society to science for society, with society. Science and Public Policy, 39, pp. 751–760

Owen, R.; Bessant J.; Heintz M. (eds.), 2013a: Responsible innovation. Managing the responsible emergence of science and innovation in society. London: John Wiley

Owen, R.; Macnaghten P.; Stilgoe J.; Gorman M.; Fisher E.; Guston D., 2013b: A framework for responsible innovation. In: Owen, R.; Heintz, M.; Bessant, J. (eds.): pp. 27-50

Pellé, S.; Nurock V.; 2012: Of Nanochips and Persons: Toward an ethics of diagnostic technology in personalized medicine. Nanoethics, 6/3: p. 155-165

Pellé, S.; Reber B.; 2016 forthcoming. From Ethics in Research to Responsible Innovation, ISTE Publications

Pellé, S.; Reber B., 2015: Responsible Innovation in the Light of Moral Responsibility. Journal on Chain and Network, 15(2), p. 1-11

Stilgoe, J.; Owen, R.; Macnaghten, P. 2013: Developing a framework for responsible innovation. Research Policy, 42, pp. 1568– 1580

Tronto, J., 2013: Caring democracy, Market, Equality and Justice. NY University Press

Tronto, J., 1993, (2009): Moral Boundaries: a Political Argument for an Ethics of Care, New York, Routledge

Tronto J.; Fisher B., 1990: Toward a Feminist Theory of Caring. In: Abel, E.; Nelson, M. (eds.), Circles of Care. Albany: SUNY Press, pp. 36-54

von Schomberg, R., 2013: A vision of responsible innovation. In: Owen, R.; Heintz, M.; Bessant, J. (eds.), pp. 51-74

Footnotes:

1) “[T]o be competent to care, given one’s caring responsibility is not simply a technical issue but a moral one” (Tronto, 2013, p. 35).

2) In her 2013 book, Tronto adds a fifth element which is “plurality, communication, trust and respect: solidarity, caring with” (Tronto, 2013, p. 35).

3) The epistemological assumption of inter-related individuals does not imply that they cannot act freely or that they never exert autonomous capacities.

4) Nuclear scientists are collectively responsible for the development of nuclear weapons even if they are not personally involved in this industry.

Specific Challenges for Responsible Research and Innovation, p. 69.

Borsella, E., Porcari, A., Mantovani, E., 2015. Delphi Exercise Report and 1st Draft Implementation Plan. Responsible-Industry project

European Commission, 2013. Options for Strengthening Responsible Research and Innovation (Report of the Expert Group on the State of Art in Europe on Responsible Research and Innovation). Publications Office of the European Union, Luxembourg

European Commission, 2012. Responsible Research and Innovation - Europe’s ability to respond to societal challenges. European Commission, Publications Office, Brussels

Jasanoff, S., 2011. Constitutional Moments in Governing Science and Technology. Sci Eng Ethics 17, 621–638. doi:10.1007/s11948-011-9302-2

Lim, D., 2013. Brain simulation and personhood: a concern with the Human Brain Project. Ethics Inf Technol 1–13. doi:10.1007/s10676-013-9330-5

Rose, N., 2014. The Human Brain Project: Social and Ethical Challenges. Neuron 82, 1212–1215. doi:10.1016/j.neuron.2014.06.001

Stahl, B.C., 2013. Responsible research and innovation: The role of privacy in an emerging framework. Science and Public Policy 40, 708–716. doi:10.1093/scipol/sct067

Stilgoe, J., Owen, R., Macnaghten, P., 2013. Developing a framework for responsible innovation. Research Policy 42, 1568–1580. doi:10.1016/j.respol.2013.05.008

von Schomberg, R., 2013. A vision of Responsible Research and Innovation, in: Owen, R., Heintz, M., Bessant, J. (Eds.), Responsible Innovation. Wiley, pp. 51–74

Footnotes:

1) https://www.epsrc.ac.uk/research/framework/, 18.05.2015

Acknowledgements:

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 604102 (Human Brain Project) and 609817 (Responsible-Industry).

The author would like to thank in particular the members of the Italian Association for Industrial Research (AIRI) (Elisabetta Borsella, Andrea Porcari, Elvio Mantovani) for the permission to reuse material from the Delphi Study of the Responsible-Industry project.

Governance of Nanomaterials as Laboratory for RRI, p. 75.

Dreyer, M.; Renn, O., 2009: Food Safety Governance. Integrating Science, Precaution and Public Involvement. Berlin

EC, 2008: The Commission Recommendation of 07/02/2008 on a Code of Conduct for Responsible Nanosciences and Nanotechnologies Research. C (2008) 424 final; Brussels

EC, 2011: Initiative for a Commission Recommendation on „Responsible Research and Innovation". European Commission. EUR25766 EN; Brussels

Grunwald, A., 2014: Responsible research and innovations: an emerging issue in research policy rooted in the debate on nanotechnology. In: Arnaldi, S.; Ferrari, A.; Magaudda, P.; Marin, F. (eds.): Responsibility in nanotechnology development. Dordrecht, pp. 191-205

Guston, D.H., 2000: Retiring the social contract of science. In: Issues in science and technology 16/4 (2000); http://issues.org/16.4/p_guston.htm (download 30.06.2015)

IRGC, 2006: White paper no. 2 on nanotechnology risk governance. International Risk Governance Council. Geneva

Jahnel, J.B.; Fleischer, T., in press 2015: Gestaltungsspielräume für 'Responsible Research and Innovation': Erfahrungen aus der Risiko-Governance von Nanomaterialien. In: Bogner, A.; Decker, M.; Sotoudeh, M. (eds.): Responsible Innovation. Neue Impuse für die Technikfolgenabschätzung? Berlin

Lyall, C.; Tait, J., 2005: Developing an Integrated Policy Approach to Science, Technology, Risk and the Environment. Hants

NRC, 1983: Risk assessment in the federal government: managing the process. National Research Council. Washington

NRC, 2009: Science and Decisions: Advancing Risk Assessment. National Research Council. Washington

Regulation EU 1291 (2013) of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC. In: OJ L 347 (2013), pp. 104-172

Scientific Committee on Health and Environmental Risks (SCHER), Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), Scientific Committee on Consumer Safety (SCCS), 2013: Opinion on making risk assessment more relevant for risk management. European Commission, Brussels; http://ec.europa.eu/health/scientific_committees/consumer_safety/docs/sccs_o_130.pdf (download 30.06.2015)

Stilgoe, J.; Owen, R.; Macnaghten, P., 2013: Developing a framework for responsible innovation. In: Research Policy 42 (2013), pp. 1568-1580

Tallacchini, M., 2009: Governing by values, EU ethics: soft tool, hard effects. Minerva 47 (2009), pp. 281-306

von Schomberg, R., 2013: A vision of responsible innovation. In: Owen, R.; Heintz, M.; Bessant, J. (eds.): Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society. Chichester, pp. 51-74

Wickson, F.; Carew, A.L., 2014: Quality criteria and indicators for responsible research and innovation: learning from transdisciplinarity. In: Journal of Responsible Innovation 1/3 (2014), pp. 254-273

Footnotes:

1) e.g. GREAT: Governance for REsponsible innovATion, http://www.great-project.eu/, RRI Tools: http://www.rri-tools.eu/de, Responsible Industry: http://www.responsible-industry.eu/

On the Convergence of TA with Ethics in RRI. Challenges to Public Engagement, p. 81.

Arnstein, Sherry R (1969) 'A Ladder of Citizen Participation' in Journal of the American Planning Association, Vol. 35, No. 4, July, pp. 216-224

EU Commission (n.d.) 'Responsible Research and Innovation', [Online] http://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation

Grunwald, Armin (2011) Responsible Innovation: Bringing together Technology Assessment, Applied Ethics, and STS research, Enterprise and Work Innovation Studies, Vol. 7, pp. 9-31

Owen, R., Macnaghten, P., & Stilgoe, J. (2012). Responsible research and innovation: From science in society to science for society, with society. Science and Public Policy, 39(6), 751–760

Owen, Richard, Stilgoe, J., Macnaghten, P., Gorman, M., Fisher, E., & Guston, D. (2013). A Framework for Responsible Innovation, 27–50

Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. Research Policy, 42(9), 1568–1580

Sørensen, Eva (2013) Institutionalizing interactive governance for democracy, Critical Policy Studies, 7:1, 72-86

von Schomberg, R. (2013). A vision of responsible research and innovation. In R. Owen, J. Bessant, & M. Heintz (Eds.), Responsible Innovation: managing the responsible emergence of science and innovation in society (pp. 51–74). West Sussex: John Wiley and Sons Ltd.

Footnotes:

1) Please note that we are ourselves partners in the SATORI project. This analysis should not be read as a critique as such, but rather as an attempt to understand and reflect on this important exercise of which we are part.

Responsible Innovation as a Critique of Technology Assessment, p. 87.

Callon, M, P. Lascoumes and Y. Barthe (2009), Acting in an Uncertain World, An Essay on Technical Democracy, Cambridge, MA: MIT Press

Daimer, S., M. Hufnagl, and P. Warnke. 2012. "Challenge-Oriented Policy-Making and Innovation SystemsTheory: Reconsidering Systemic Instruments." In Innovation System Revisited – Experiences from 40 Years of Fraunhofer ISI Research, Stuttgart: Fraunhofer Verlag, 217–234

Grinbaum, A, and C Grove. 2013. What is "responsible" about Responsible Innovation? Understanding the ethical issues. In R. Owen, J. Bessant, M Heintz (eds.) Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society. London: Wiley, 119–142

Owen, R, J Bessant, and M Heintz (eds.). 2013. Responsible Innovation. Managing the Responsible Emergence of Science and Innovation in Society. Chichester: John Wiley & Sons

Rip, A. (2014), The Past and Future of RRI, Life Sciences, Society and Policy, Vol 17

Schot, J. and A. Rip (1997), The Past and Future of Constructive Technology Assessment, Technological Forecasting & Social Change 54, 251-268

Stilgoe, J., Owen, R. and Macnaghten, P. (2013) 'Developing a framework for responsible innovation', Research Policy 42(9): 1568-1580

Von Schomberg, R. (2013), A vision of responsible research and innovation. In: R. Owen, J. Bessant, M Heintz (eds.) Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society. London: Wiley, pp. 51–74

Zwart, H, L Laurens, and R Arjan Van. 2014. Adapt or perish? assessing the recent shift in the European research funding arena from 'ELSA' to 'RRI'. Life Sciences, Society and Policy 10(11)

Assessing Stakeholders' Needs and Constraints Related to RRI, p. 93.

Baur, V.E., Van Elteren, A.H.G., Nierse, C.J., Abma, T.A., 2010. Dealing with Distrust and Power Dynamics: Asymmetric Relations among Stakeholders in Responsive Evaluation. Evaluation 16, 233–248. doi:10.1177/1356389010370251

Creek, M., Marschalek, Ilse, Handler, K., Smallman, M., Steinhaus, N., Alix, J.-P., Van Dyck, L., De Harambure, A., Goncalves, J., Debry, M., Giannokopoulou, A., 2014. D 2.1 - Guidelines for the implementation of the stakeholder consultation in relation to RRI (Deliverable No. D 2.1). Ecsite, ZSI, University College London, CIPAST, Euroscience, European Business Network, European Schoolnet

Human, B.A., Davies, A., 2010. Stakeholder consultation during the planning phase of scientific programs. Mar. Policy 34, 645–654. doi:10.1016/j.marpol.2009.12.003

Klaassen, P., Kupper, F., Broerse, J., 2014. Policy brief on the state of the art on RRI and a working definition of RRI (Deliverable No. D 1.1.), RRI tools. Athena Institute, VU University Amsterdam, Amsterdam

Kupper, F., Klaassen, P., Rijnen, M., Vermeulen, S., Broerse, J., 2015. D 1.3. Report on the quality criteria of Good Practice Standards in RRI

Marschalek, Ilse, Handler, K., Hofer, M., Voigt, C., 2014. Report on "Coverage of RRI aspects in STI (Science, Technology, Innovation) evaluations" (RRI tools project deliverable No. D 5.1.), RRI tools. Centre for Social Innovation, Vienna

Owen, R., Macnaghten, P., Stilgoe, J., 2012. Responsible research and innovation: From science in society to science for society, with society. Sci. Public Policy 39, 751–760. doi:10.1093/scipol/scs093

Owen, R., Stilgoe, J., Macnaghten, P., Gorman, M., Fisher, E., Guston, D., 2013. A framework for responsible innovation. Responsible Innov. Manag. Responsible Emergence Sci. Innov. Soc. 27–50

Smallman, M., Lomme, K., Faullimmel, N., 2015. D 2.2. Report on the analysis of opportunities, obstacles and needs of the stakeholder groups in RRI practices in Europe

Stilgoe, J., Owen, R., Macnaghten, P., 2013. Developing a framework for responsible innovation. Res. Policy 42, 1568–1580. doi:10.1016/j.respol.2013.05.008

Acknowledgements:

I would like to thank all the hub coordinators who carried out the consultation workshop and of course all the participants. I would also like to thank the partners from ECSITE (European Network of Science Centres and Museums) for their collaboration in developing the workshop methodology and the partners from UCL (University College, London) for the qualitative data analysis.

Footnotes:

1) All data based on D 2.2. Report on the analysis of opportunities, obstacles and needs of the stakeholder groups in RRI practices in Europe by University College London.

Limits of Public Participation for Complex Policy Problems, p. 101.

Calvert, A.M.; Bishop, C.A.; Elliot, R.D.; Krebs, E. A.; Kydd, T.M.; Machtans, C.S.; Robertson, G.J., 2013: A synthesis of human-related avian mortality in Canada. In: Avian Conservation and Ecology 8/2 (2013), pp. 11-17

Cowell, R.; Bristow, G.; Munday, M., 2011: Acceptance, acceptability and environmental justice: the role of community benefits in wind energy development. In: J. Environmental Planning and Management 54/4 (2011), pp. 539-557

Crichton, F.; Dodd, G.; Schmid, G.; Gamble, G.; Petrie, K.J., 2014: Can expectations produce symptoms from infrasound associated with wind turbines? In: Health Psychol. 33/4 (2014), pp. 360-364

Crouch, C., 2004: Post-Democracy. Oxford

DIN 45680, 1997: Messung und Bewertung 2: Tieffrequente Geräuschemissionen in der Nachbarschaft

Geraint, E.; Barry, J.; Clive, R., 2007: Many Ways to Say ‚No', Different Ways to Say ‚Yes': Applying Q-Methodology to Understand Public Acceptance of Wind Farm Proposals. In: J. Environmental Planning and Management 50/4 (2007), pp. 517-551

Fliegenschnee, M.; Mahringer, F., 2015: IG Windkraft Austria. Personal Communication

Gudowsky, N.; Bechtold, U., 2013: The Role of Information in Public Participation. In: Journal of Public Deliberation 9/1 (2013)

Hall, N.; Ashworth, P.; Devine-Wright, P., 2013: Societal acceptance of wind farms: Analysis of four common themes across Australian case studies. In: Energy Policy 58 (2013), pp. 200-208

Hau, E., 2014: Windkraftanlagen: Grundlagen, Technik, Einsatz, Wirtschaftlichkeit. Berlin Heidelberg

Kahane, D.; Loptson, K.; Herriman, J.; Hardy, M., 2013: Stakeholder and Citizen Roles in Public Deliberation. In: Journal of Public Deliberation 9/2 (2013)

Kant, I., 1784: Answering the Question: What Is Enlightenment?

Klessmann, C.; Held, A.; Rathmann, M.; Ragwitz, M., 2014: Status and perspectives of renewable energy policy and deployment in the European Union – What is needed to reach the 2020 targets? In: Energy Policy 39 (2014), pp. 7637-7657

Monstadt, J.; Wolff, A., 2015: Energy transition or incremental change? Green policy agendas and the adaptibility of the urban energy regime in Los Angeles. In: Energy Policy 78 (2015), pp. 213-224

Nadai, A., 2007: "Planning", "siting" and the local acceptance of wind power: Some lessons from the French case. In: Energy Policy 35 (2007), pp. 2715-2726

Negin, E., 2013: The Wind Energy Threat to Birds Is Overblown. Union of Concerned Scientists; http://www.livescience.com/41644-wind-energy-threat-to-birds-overblown.html (download 22.5.14)

Pegels, A.; Lütkenhorst, W., 2014: Is Germany's energy transition a case of successful green industrial policy? Contrasting wind and solar PV. In Energy Policy 74 (2014), pp. 522-534

Rask, M.; Worthington, R.; Lammi, M., 2012: Citizen Participation in Global Environmental Governance. London

Swoford, J.; Slattery, M., 2010: Public attitudes of wind energy in Texas: Local communities in close proximity to wind farms and their effect on decision-making. In: Energy Policy 38 (2010), pp. 2508-2519

Menges, H.; Krahé, D.; Staiger, B., 2015: Bundesimmissionsschutzgesetz und Umwelthygiene II: Tieffrequenter Schall und Infraschall. 18.Umwelttoxikologisches Kolloquium; www.gesundheitsamt-bw.de/MLS/Documents/Berichtsband_Frtbldg_Infraschall.pdf (download 22.5.15)

Wiek, A.; Talwar, S.; O'Shea, M.; Robinson, J., 2014: Toward a methodological scheme for capturing societal effects of participatory sustainability research. In: Research Evaluation 23/2 (2014), pp.117-132

Wolsink, M., 2007: Wind power implementation: The nature of public attitudes: Equity and fairness instead of 'backyard motives'. In: Renewable and Sustainable Energy Reviews 11/6 (2007), pp. 1188-1207

Wüstenhagen, R.; Wolsink, M.; Bürer, M.J., 2007: Social acceptance of renewable energy innovation: An introduction to the concept. In: Energy Policy 35 (2007), pp. 2683-2691

Footnotes:

1) "Not In My BackYard" (NIMBY) – individual perspective of opposing a certain measure/plan/project in a persons' surrounding – but no general opposition as to the measure/plan/project itself. The Oxford English Dictionary identifies the acronym's earliest use as being in the 1980ies.
2) http://ec.europa.eu/clima/policies/package/index_en.htm
3) http://www.bmwfw.gv.at/EnergieUndBergbau/Energiebericht/Documents/Energy%20Strategy%20Austria%20(engl%20Kurzfassung)%20(2).pdf
4) http://ec.europa.eu/environment/aarhus/

The Study Commission "The Internet and the Digital Society" in Germany, p. 107.

Henseling, C.; Opielka, M.; Evers-Wölk, M.; Oertel, B.; Kahlisch, C., 2015: Konzeptionelle Informationen zum Stakeholder Panel TA und erste Ergebnisse der Online-Befragung "Ausbau der Stromnetze im Rahmen der Energiewende". Berlin

Deutscher Bundestag, 2010: Antrag der Fraktionen CDU/CSU, SPD, FDP und BÜNDNIS 90/DIE GRÜNEN. Einsetzung einer Enquete-Kommission „Internet und digitale Gesellschaft". Drucksache 17/950, Berlin

Deutscher Bundestag, 2013: Beschlussvorlage für die Enquête-Kommission „Internet und Digitale Gesellschaft". Drucksache 17(24)069, Berlin

Deutscher Bundestag, 2013: Schlussbericht der Enquete-Kommission „Internet und digitale Gesellschaft". Drucksache 17/12550, Berlin

Deutscher Bundestag, 2015: Der Jahresbericht des Petitionsausschusses. Ausgabe 2014. Berlin

Jungherr, A.; Jürgens, P., 2010: The Political Click: Political Participation through E-Petitions in Germany. In: Policy & Internet 2 (4), pp. 131–165

Lindner, R.; Riehm, U. 2011: Broadening Participation through E-Petitions? An Empirical Study of Petitions to the German Parliament. International Parliamentary E-Petition Systems in Comparative Perspective. In: Policy & Internet 3 (1), S. 63–85

Luhmann, N., 1969: Legitimation durch Verfahren. Frankfurt

Oertel, B.; Kahlisch, C.; Meyer, S., 2014: Online-Bürgerbeteiligung an der Parlamentsarbeit. Berlin

Opielka, M.; Evers-Wölk, M.; Henseling, C.; Oertel, B., 2014: Dialogprozesse und Diskursanalysen. In: TAB-Brief 43 (2014), pp. 10-13

Reichert, D.; Paetsch, J., 2012: Liquid Democracy. Neue Wege der politischen Partizipation. In: Vorgänge 4 (2012), pp. 15–22

Riehm, U.; Böhle, K.; Lindner, R, 2013: Elektronische Petitionssysteme. Analysen zur Modernisierung des parlamentarischen Petitionswesens in Deutschland und Europa. Berlin

Vowe, G., 2014: Digital Citizens und Schweigende Mehrheit: Wie verändert sich die politische Beteiligung der Bürger durch das Internet? – Ergebnisse einer kommunikationswissenschaftlichen Langzeitstudie. In Voss, K. (ed.): Internet und Partizipation. Bottom-up oder Top-down? Politische Beteiligungsmöglichkeiten im Internet. Hamburg, pp. 25 -52

Approaching Synthetic Biology for Societal Evaluation and Public Dialogue, p. 115.

Austin, J.L., 1962: How to do Things with Words: The William James Lectures delivered at Harvard University in 1955. Oxford

Benner, S.A., Sismour, A.M., 2005: Synthetic biology. In: Nature Reviews Genetics 6 (2005), pp. 533-543

Blazeski, G., 2014: The Need for Government Oversight Over Do-It-Yourself Biohacking, the Wild West of Synthetic Biology. In: Law School Student Scholarship. Paper 411, http:// http://scholarship.shu.edu/student_scholarship/411 (download 30.06.2015)

Bogner, A., 2012: The Paradox of Participation Experiments. In: Science, Technology & Human Values, 37/5 (2012), pp. 506-527

Boldt, J., Müller, O., Maio, G., 2009: Synthetische Biologie: Eine ethisch-philosophische Analyse. Bern

Charisius, H., Friebe, R., Karberg, S., 2013: Biohacking - Gentechnik aus der Garage. Munich

Collingridge, D., 1980: The Social Control of Technology. London

Fitzgerald, D., Littlefield, M. M., Knudsen, K. J., Tonks, J., Dietz, M. J., 2014: Ambivalence, equivocation and the politics of experimental knowledge: A transdisciplinary neuroscience encounter. In: Social Studies of Science, online first, doi: 10.1177/0306312714531473

Fussenegger, M., 2014: Kunst oder künstlich? Chancen, Risiken und Perspektiven der Synthetischen Biologie. Neue Zürcher Zeitung, 2 Jul 2014, http://www.nzz.ch/ wissenschaft/biologie/chancen-risiken-und-perspektiven-der-synthetischen-biologie-1.18334868 (download 14.08.14)

Grunwald, A., 2010: Technikfolgenabschätzung - eine Einführung. 2. Auflage. Berlin

Hennen, L., 2012: Why do we still need participatory technology assessment? In: Poiesis & Praxis: international journal of ethics of science and technology assessment 9/1-2 (2012), pp. 27-41

Kaiser, M., Hauser, C., Haslinger, J., Gazsó, A., 2014: Governing by dialogue. In: Gazsó, A., Haslinger, J. (eds.): Nano Risiko Governance: Der gesellschaftliche Umgang mit Nanotechnologien (pp. 259-282). Wien

Kollek, R., Döring, M., 2012: TA-Implikationen der komplexen Beziehung zwischen Wissenschaft und Technik. In: Technikfolgenabschätzung – Theorie und Praxis 21/2 (2012), pp. 4-9

König, H., Frank, D., Heil, R., Coenen, C., 2013: Synthetic Genomics and Synthetic Biology Applications Between Hopes and Concerns. In: Current Genomics 14 (2013), pp. 11-24

Mackenzie, A., 2013: The economic principles of industrial synthetic biology: cosmogony, metabolism and commodities. In: Engineering Studies 5/1 (2013), pp. 74-89

Nash, D.B., 2010: Beware Biohacking? In: Biotechnology Healthcare 7/1 (2010), pp. 7-7.

Nordmann, A., 2011: The Age of Technoscience. In: Nordmann, A., Radder, H., Schiemann, G. (eds.): Science Transformed? Debating Claims of Epochal Breaks (pp. 19-30). Pittsburgh

Pauwels, E., 2013: Metaphors and Cohabitation Within and Beyond the Walls of Life Sciences. In: Doorn, N., Schuurbiers, D., van de Poel, I., Gorman, M.E. (eds.): Early engagement and new technologies: Opening up the laboratory (pp. 207-230). Berlin/Heidelberg

Rabinow, P., Bennett, G., 2012: Designing Human Practices: An Experiment with Synthetic Biology. Chicago

Seitz, S.B., 2015: Let's talk about… Synthetic Biology – Emerging Technologies and the Public. In: Hagen, K., Engelhard, M., Toepfer, G. (eds.): Ambivalences of Creating Life. Societal and Philosophical Dimensions of Synthetic Biology (pp. 157-156). Berlin/Heidelberg

Stilgoe, J., Owen, R., Macnaghten, P., 2013: Developing a framework for responsible innovation. In: Research Policy 42/9 (2013), pp. 1568-1580

Sturgis, P., 2014: On the limits of public engagement for the governance of emerging technologies. In: Public Understanding of Science 23/1 (2014), pp. 38-42

Vincent, B.B., 2013: Between the possible and the actual: Philosophical perspectives on the design of synthetic organisms. In: Futures 48 (2013), pp. 23-31

Von Schomberg, R., 2013: A Vision of Responsible Research and Innovation. In: Owen, R., Bessant, J., Heintz, M. (eds.): Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society (pp. 51-74). Hoboken

Wynne, B., 2007: Public participation in science and technology: performing and obscuring a political-conceptual category mistake. In: East Asian Sci Technol Soc Int J 1/1 (2007), pp. 99-110

Footnotes:

1) For a description of the contents of the session, I partially cite the abstracts that are available online at http://www.pacitaproject.eu/wp-content/uploads/2015/03/Book-of-Abstracts-UPDATED3.pdf (download 30.6.15).

2) For more information see the coming publications of V. Rerimassie and the project homepage at http://www.rathenau.nl/themas/thema/project/synthetische-biologie/meeting-of-young-minds.html (download 30.6.15).

3) For more information about B. Wray, her activities and current projects see: http://www.brittwray.com/ (download 30.6.2015).

4) For more information about O. Catts see: http://www.uwa.edu.au/people/oron.catts (download 30.6.2015).

5) For more information about R. Trojok and his current activities in the SB field see: http://www.openbioprojects.net/ (download 30.6.2015).

6) Gesetz zur Neuordnung des Gentechnikrechts [Act Restructuring the Genetic Engineering Act], 21.12.2004, Bundesgesetzblatt [BGBl.] 1/8 (2005), pp. 186-196.

Acknowledgement:

As chair of the session “Approaching Synthetic Biology for Societal Evaluation and Public Dialogue” at the PACITA Conference 2015, I am grateful for the contributions of my speakers Virgil Rerimassie (RI), Rüdiger Trojok (KIT-ITAS), and Britt Wray (University of Copenhagen) as well as the lively discussions with the audience. I also thank Margret Engelhard (EA Bad Neuenahr-Ahrweiler) – who was unfortunately unable to take her slot due to illness – for discussion and inspiration.

“Enabling” Public Participation in a Social Conflict, p. 121.

Berkhout, F. (1991). Radioactive Waste. London: Routledge

Dry, M. (2015). Checks and Balances. In: Gibbons, M. T., Coole, D., Ellis, E. and Ferguson, K. The encyclopedia of political thought 1: A-Chr. Chichester, Wiley: 461-463

Dryzek, J. S. (1996). The Politics of the Earth. Oxford, Oxford University Press

ESK (2011). Rückholung / Rückholbarkeit Hochradioaktiver Abfälle aus einem Endlager, RSK/ESK-Geschäftsstelle beim Bundesamt für Strahlenschutz

Grande, E. (2012). Governance-Forschung in der Governance-Falle? In: PVS 53/4 (2012), S. 565-592

Kuppler, S. (2012). From Government to Governance? In: Journal of Integrative Environmental Sciences 9(2): 103-122

Langer, K. and Oppermann, B. (2003). Zur Qualität Von Beteiligungsprozessen. In: Ley, A. and Weitz, L., Praxis Bürgerbeteiligung. Bonn, Verlag Stiftung Mitarbeit: 300-306

Mauch, S. (2014). Bürgerbeteiligung. Stuttgart, Boorberg

Mayntz, R. (2009). Von politischer Steuerung zu Governance? In: Mayntz, R., Über Governance. Frankfurt a.M./New York, Campus: 105-120

NEA (2012). Indicators in the Safety Case. A report of the Integrated Group on the Safety Case (IGSC), Paris: NEA/RWM/R(2012)7

Scharpf, F. 1999. Governing in Europe. Oxford University Press: Oxford

Stahlmann, J. et al. (2014). Generische Tiefenlagermodelle mit Option zur Rückholung der radioaktiven Reststoffe. Report from the ENTRIA-workpackage 3.1, Version 1.1, Braunschweig, September 2014, 31 pages

Torfing, J. (2006). Governance Networks and Their Democratic Anchorage. In: Melchior, J. New Spaces of European Governance. Vienna, University of Vienna: 109-128

US Department of Energy (2001). Developing the Report to Congress on Long-Term Stewardship. Department of Energy, 29 pp.

Footnotes:

1) The work presented here can be classified as a scoping study and is part of the ITAS work package within the Project ENTRIA funded by the German Federal Ministry of Education and Research (funding number 02S9082D). (See www.entria.de and www.itas.kit.edu/projekte_hock13_entria.php)

2) In ENTRIA the third option is long-term surface storage. Repositories with retrievability will be open for a longer time-span than repositories without (ESK 2011, Stahlmann et al. 2014, NEA 2012).

3) Scharpf (1999: 6) distinguishes between two types of legitimacy: "Input-oriented democratic thought emphasizes 'government by the people'. Political choices are legitimate if and because they reflect the 'will of the people' […]. By contrast, the output perspective emphasizes 'government for the people'…" (emphasis in the original).

4) The term "checks and balances" refers to the need for some kind of institutional balance in democracies, which ensures that governments cannot abuse their power (Dry 2015).

From Invited Participation to Blue Sky Engagement, p. 127.

Bogner, A. (2012). The Paradox of Participation Experiments. Science, Technology, & Human Values, 37(5), 506-527

Bogner, A., Torgersen, T. (2014): Capturing the Public Imagination: In-depth analysis of three or more public SYN-ENERGENE Actions. D 2.2 SYN-ENERGENE, co-funded by the European Union under the 7th Framework Programme, Karlsruhe, Germany/Wien, Austria

Bora, A. (2010). Technoscientific Normativity and the 'Iron Cage' of Law. Science, Technology & Human Values, 35(1), 3-28

Callon, M., Lascoumes, P., & Barthe, Y. (2011). Acting in an Uncertain World. An Essay on Technical Democracy. Cambridge: The MIT Press

Collins, H., & Evans, R. (2007). Rethinking Expertise. Chicago and London: University of Chicago Press

Delfanti, A. (2013). Biohackers. The Politics of Open Science. London: Pluto Press

Delgado, A., Kjølberg, K. L., & Wickson, F. (2011). Public engagement coming of age: From theory to practice in sts encounters with nanotechnology. Public Understanding of Science, 20(6), 826-845

Fischer, F. (2000). Citizens, Experts, and the Environment. The Politics of Local Knowledge. Durham and London: Duke University Press

Grunwald, A. (2009). Technology Assessment: Concepts and Methods. In A. Meijers (Ed.), Philosophy of Technology and Engineering Sciences (Handbook of the Philosophy of Science, Vol 9), pp. 1103-1146. Amsterdam: Elsevier

Irwin, A. (2001). Constructing the scientific citizen: Science and democracy in the biosciences. Public Understanding of Science, 10(1), 1-18

Kleinman, D. L., Delborne, J. A., & Anderson, A. A. (2011). Engaging citizens: The high cost of citizen participation in high technology. Public Understanding of Science, 20(2), 221-240

Kurath, M., & Gisler, P. (2009). Informing, involving or engaging? Science communication, in the ages of atom-, bio- and nanotechnology. Public Understanding of Science, 18(5), 559-573

Navid, E. L., & Einsiedel, E. F. (2012). Synthetic biology in the Science Café: what have we learned about public engagement? Journal of Science Communication, 11(4), A02

Nordmann, A. (2011). The Age of Technoscience. In A. Nordmann, H. Radder & G. Schiemann (Eds.), Science Transformed? Debating Claims of Epochal Breaks (pp. 19-30). Pittsburgh: Pittsburgh University Press

Rowe, G., & Frewer, L. J. (2005). A Typology of Public Engagement Mechanisms. Science, Technology & Human Values, 30(2), 251-290

Rucht, D. (2003). The Changing Role of Political Protest Movements. In H. Kitschelt & W. Streek (Eds.), Germany Beyond the Stable State, Special Issue West European Politics, Vol. 26, No. 4 (pp. 153-176)

Stirling, A. (2008). "Opening Up" and "Closing Down": Power, Participation, and Pluralism in the Social Appraisal of Technology. Science, Technology & Human Values, 33(2), 262-294

Von Schomberg, R. (2013). A Vision of Responsible Research and Innovation. In R. Owen, J. Bessant & M. Heintz (Eds.), Responsible Innovation. Managing the Responsible Emergence of Science and Innovation in Society (pp. 51-74). Chichester: Wiley

Wehling, P., Viehöver, W., & Koenen, S. (Eds.). (2015). The Public Shaping of Medical Research. Patient Associations, Health Movements and Biomedicine. New York/London: Routledge

Wilsdon, J., & Willis, R. (2004). See-through Science: Why public engagement needs to move upstream. London: Demos

Wynne, B. (2007). Public Participation in Science and Technology: Performing and Obscuring a Political-Conceptual Category Mistake. East Asian Science, Technology and Society: an International Journal, 1(1), 99-110

Footnotes:

1) The outcomes of these two participation experiments are detailed in documents to be accessed via the homepage of the organisers; see http://www.bbsrc.ac.uk/engagement/dialogue/activities/synthetic-biology and http://www.raeng.org.uk/publications/reports/syn-bio-dialogue-report, respectively.

2) The project homepage provides further information on current public engagement activities, see www.synenergene.eu.

3) See www.nanotruck.de/en/home.html

4) For further information see http://bio-fiction.com/2014.

5) The term citizen science has been established to describe an open and decentralized form of producing scientific knowledge where lay people can substantially contribute. Some participants of the biofaction film festival in Vienna considered citizen science to be a better way of knowledge production by avoiding shortcomings due to the narrow-mindedness of scientific experts. This view was challenged by other participants who put citizen science on a level with activities undermining the valid quality criteria of science.

The Interface between the Public and Science and Technology, p. 133.

Bauer, M. W.; Allum, N.; Miller, S., 2007: What can we learn from 25 years of PUS survey research? Liberating and expanding the agenda. In: Public Understanding of Science 16, pp. 79-95

Bogner, A., 2010: Partizipation als Laborexperiment. Paradoxien der Laiendeliberation in Technikfragen. In: Zeitschrift für Soziologie 39/2, pp. 87-105

Collingridge, D., 1982: The social control of technology. London, Pinter

Einsiedel, E., 2001: Citizen Voices: Public Participation on Biotechnology. In: Notizie di Politeia XVII, N. 63, pp.94-113

Goldschmidt, R.; Scheel, O.; Renn, O., 2012: Zur Wirkung und Effektivität von Beteiligungsmaßnahmen. Stuttgarter Beiträge zur Risiko- und Nachhaltigkeitsforschung. http://elib.uni-stuttgart.de/opus/volltexte/2012/7264/pdf/AB023_Goldschmidt_et_al_2012.pdf, retrieved May 15th 2015

Goodin, R., 2008: Innovating Democracy. Democratic Theory and Practice after the Deliberative Turn. New York, Oxford University Press

Habermas, J., 1968: Technik und Wissenschaft als Ideologie. Frankfurt/Main, Suhrkamp.

Joly, P.-B.; Kaufmann, A., 2009: Lost in Translation? The need for upstream Engagement with Nanotechnology on Trial. In: Science as Culture 17/3, pp. 1-23

Klüver, L. et al. 2000: EUROPTA. European Participatory Technology Assessment. Participatory Methods in Technology Assessment and Technology Decision Making. http://www.tekno.dk/pdf/projekter/europta_Report.pdf, retrieved May 15th, 2015.

Ogburn, W. F., 1922: Social Change with respect to culture and original nature. New York, B.W. Huebsch Inc.

Owen, R.; Macnaghten, P; Stilgoe, J., 2012: Responsible Research and Innovation: From Science in Society to Science for Society. In: Science and Public Policy 39, pp.751-760

Rowe, G.; Frewer, L.J, 2005: A Typology of Public Engagement Mechanisms. In: Science, Technology, & Human Values 30/2, pp.251-290

Schelsky, H., 1965: Der Mensch in der wissenschaftlichen Zivilisation. In: Schelsky (ed.): Auf der Suche nach Wirklichkeit: Gesammelte Aufsätze. Düsseldorf/Köln, Eugen Diderichs Verlag, pp. 439-480

Von Schomberg, R., 2011: Prospects for Technology Assessment in a Framework of Responsible Research and Innovation. In: Dusseldorp, M., Beecroft, R. (eds.): Technikfolgen abschätzen lehren. Wiesbaden, Springer VS

Weyer, J., 2008: Techniksoziologie. Genese, Gestaltung und Steuerung sozio-technischer Systeme. Weinheim and Munich, Juventa

Wynne, B., 1992: 'Misunderstood Misunderstandings: Social Identities and Public uptake of Science'. In: Public Understanding of Science 1, pp. 281–304

Wynne, B., 2006: Public Engagement or dialogue as a means of restoring public trust in science? Hitting the notes but missing the music. In: Community Genetics 9/3, pp. 211-220

Participatory Foresight. Experiences with a Qualitative Demand-Side Approach, p. 139.

Engage 2020 Consortium, 2015: Engage2020 – Tools and instruments for a better societal engagement in "Horizon 2020", Engaging Society in Horizon 2020, D3.2 Public Engagement Methods and Tools http://engage2020.eu/media/D3-2-Public-Engagement-Methods-and-Tools-3.pdf

Grunwald, A., 2014: Modes of orientation provided by futures studies: making sense of diversity and divergence. In: European Journal of Futures Research (2014), 15:30, DOI 10.1007/s40309-013-0030-5

Gudowsky, N.; Peissl, W.; Sotoudeh, M.; Bechtold, U., 2012: Forward-looking activities: incorporating citizens´ visions. In: Poiesis & Praxis (online first: 15/11/2012). http://dx.doi.org/10.1007/s10202-012-0121-6

Gudowsky, N.; Sotoudeh, M., 2015: Citizens' Visions on Active Assisted Living. In: Hayn, D.; Schreier, G.; Ammenwerth, E.; Hörbst, A. (eds.): eHealth2015 – Health Informatics Meets eHealth, Studies in Health Technology and Informatics, Volume 212, pp. 43 – 49, Amsterdam: IOS Press, ISBN 978-1-61499-523-4 (print) | 978-1-61499-524-1 (online), DOI 10.3233/978-1-61499-524-1-43, Open Access: http://ebooks.iospress.nl/volumearticle/39701

Gudowsky, N.; Sotoudeh, M.; Capari, L., 2014: Leben2050 – Bürgerbeteiligung in einer vorausschauenden Studie zu selbstbestimmtem Leben im Alter in Wien. In: Schrenk, M., Popovich, V., Zeile, P., Elisei, P. (eds.) Proceedings REAL CORP 2014 (REAL CORP 2014); Vienna, S. 349-356 . http://programm.corp.at/cdrom2014/papers2014/CORP2014_152.pdf

Jasanoff, S.; Kim, S., 2009: Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea. Minerva 47, (2009) pp. 119-146

Footnotes:

1) CIVISTI - Citizen Visons on Science, Technology and Innovation: CIVISTI asks how the future should look like to be able to stipulate and govern innovations actively. Citizens develop visions regarding a desirable future in 30-40 years. On the basis of these visions, experts and stakeholders formulate recommendations for research programme and technology development, which are then again presented to the citizens for validation and prioritization.

Shaping Future. New Methods for Participatory Technology Foresight, p. 145.

Blackwell, A. F.; Wilson, L.; Street, A.; Boulton, C.; Knell, J., 2009: Radical innovation: crossing knowledge boundaries with interdisciplinary teams. NESTA Report. Cambridge

Chesbrough, H. W., 2003: Open innovation: The new imperative for creating and profiting from technology. Boston

Grunwald, A., 2012: Technikzukünfte als Medium von Zukunftsdebatten und Technikgestaltung. Karlsruher Studien: Vol. 6. Karlsruhe

Hippel, E. von, 2005: Democratizing innovation. Cambridge

Jørgensen, M. S.; Jørgensen, U.; Clausen, C., 2009: The social shaping approach to technology foresight. In: Futures 41/2 (2009), pp. 80–86

Martin, B.; Hanington, B. M., 2012: Universal methods of design. Beverly

Owen, R.; Macnaghten, P.; Stilgoe, J., 2012: Responsible research and innovation: From science in society to science for society, with society. In: Science Public Policy 39/6 (2012), pp. 751-760

Peschl, M. F., 2007: Enabling Spaces. In: Gronau, N. (ed.): Professionelles Wissensmanagement. Erfahrungen und Visionen. Berlin, pp. 362-372

Schraudner, M.; Wehking, S., 2012: Fraunhofer's Discover Markets: Fostering Technology Transfer by Integrating the Layperson's Perspective. In: Audretsch, D. et al. (eds.): Technology Transfer in a Global Economy, New York, pp. 367-374

Woolley, A. W.; Chabris, C. F.; Pentland, A.; Hashmi, N.; Malone, T. W., 2010: Evidence for a Collective Intelligence Factor in the Performance of Human Groups. In: Science, 330/6004 (2010), pp. 686–688

Footnotes:

1) Exploratory stage: 2011-2012, founded by the German Federal Ministry of Education and Research, Grant ID: 16|1630. Main stage: 2014-2017, founded by the German Federal Ministry of Education and Research, Grant ID: 16I1639.

2) According to Blackwell et al. (2009: 71) the "silo" metaphor "implies depth (of knowledge), accumulation, and investment in resources (of knowledge) against some future time in which they might be required. […] the walls of the silo are a barrier that prevents both knowledge, and the people holding that knowledge, from encounters with the outside world."

Enriching the Methodological Scope of Technology Assessment, p. 151.

Albrecht, S., 2014: Responsible Research Implementieren. Zur praktischen Umsetzung von RRI am Beispiel des Projekts "Synenergene" zur Synthetischen Biologie. Paper presented at NTA6-TA14, Vienna, June 2-4, 2014 (forthcoming)

Bechmann, G., 1997: Diskursivität und Technikgestaltung. In: Köberle, S.; Gloede, F.; Hennen, L. (eds.): Diskursive Verständigung? Mediation und Partizipation in Technikkontroversen. Baden-Baden, pp. 151–163

Bruce, D., 2010: Playing Democs Games to explore Synthetic Biology. http://www.edinethics.co.uk/synbio/synbio%20democs%20report.pdf (download 30.6.2015)

Collingridge, D., 1980: The Social Control of Technology. London

Doren, D.v.; Heyen, N.B., 2014: Synthetic Biology: Too Early for Assessments? A Review of Synthetic Biology Assessments in Germany. In: Science and Public Policy 41/3 (2014), pp. 272–282

Global Challenges Foundation, 2015: Global Challenges – Twelve Risks that Threaten Human Civilisation – The Case for a New Category of Risks. Stockholm

Grunwald, A., 2002: Technikfolgenabschätzung – eine Einführung. Berlin

Grunwald, A., 2009: Technology Assessment: Concepts and Methods. In: Meijers, A. (ed.): Philosophy of Technology and Engineering Sciences. Vol. 9. Amsterdam et al., pp. 1103–1146

Grunwald, A., 2012: Synthetische Biologie als Naturwissenschaft mit technischer Ausrichtung. Plädoyer für eine "Hermeneutische Technikfolgenabschätzung". In: Technikfolgenabschätzung – Theorie und Praxis 21/2 (2012), pp. 10–15

Grunwald, A., 2013: Techno-visionary Sciences. Challenges to Policy Advice. In: Science, Technology & Innovation Studies 9/2 (2013), pp. 21–38

Guston, D.H.; Sarewitz, D., 2002: Real-time Technology Assessment. In: Technology in Society 24/1 (2002), pp. 93–109

Jasanoff, S., 2003: Technologies of Humility: Citizen Participation in Governing Science. In: Minerva 41/3 (2003), pp. 223–244

Joly, P.-B.; Kaufmann, A., 2008: Lost in Translation? The Need for 'Upstream Engagement' with Nanotechnology on Trial. In: Science as Culture 17/3 (2008), pp. 225–247

Kaebnick, G.E.; Gusmano, M.K.; Murray, T.J., 2014: The Ethics of Synthetic Biology: Next Steps and Prior Questions. In: Kaebnick, G.E.; Gusmano, M.K.; Murray, T.J. (eds.): Synthetic Future: Can We Create What We Want Out of Synthetic Biology? Hastings Center Report 44/S5 (2014), pp. S4–S26

König, H.; Frank, D.; Heil, R., (2013): Science, Technology and the State: Implications for Governance of Synthetic Biology and Emerging Technologies. In: Michalek, T.; Hebáková, L.; Hennen, L.; Scherz, C.; Nierling, L.; Hahn, J. (eds.): Technology Assessment and Policy Areas of Great Transitions. Proceedings from the PACITA 2013 Conference in Prague. Prague, pp. 315–320

Leopoldina (Nationale Akademie der Wissenschaften); Institut für Demoskopie Allensbach, 2015: Die Synthetische Biologie in der öffentlichen Meinungsbildung. Halle

Lorenzet, A., 2015: The Synthetic Biology Monitor. Interview, SYNENERGENE newsletter 02, June 2015. http://synenergene.eu/sites/default/files//uploads/SynenergeneNewsletter02-SyntheticBiologyMonitor_0.pdf (download 30.6.2015)

Oldham, P.; Hall, S.; Burton, G., 2012: Synthetic Biology: Mapping the Scientific Landscape. In: PLoS One 7/4 (2012), e34368

Sauter, A., 2011: Synthetische Biologie: Finale Technisierung des Lebens – oder Etikettenschwindel? In: TAB-Brief 39 (2011), pp. 23–30

Schomberg, R.v., 2012: Prospects for Technology Assessment in a Framework of Responsible Research and Innovation. In: Dusseldorp, M.; Beecroft, R. (eds.): Technikfolgen abschätzen lehren. Wiesbaden, pp. 39–61

Schomberg, R.v., 2013: A Vision of Responsible Research and Innovation. In: Owen, R.; Heintz, M.; Bessant, J. (eds.): Responsible Innovation. London, pp. 51–74

Wickson, F.; Carew, A.L., 2014: Quality Criteria and Indicators for Responsible Research and Innovation: Learning from Transdisciplinarity. In: Journal of Responsible Innovation 1/3 (2014), pp. 254–273

Wilsdon, J.; Willis, R., 2004: See-through Science. Why Public Engagement Needs to Move Upstream. London

Willets, D., 2013: Eight Great Technologies. London

World Economic Forum, 2014: Global Risks 2014. Ninth Edition. Geneva

Footnotes:

1) The term “upstream engagement” has been criticized for implying a linear view of the innovation process (Joly/Kaufmann 2008). We acknowledge the intricate character of innovation as a process with multiple origins and the involvement of many actors, but retain the term to refer to the shift in the history of TA.

2) A recent representative survey of the German population has shown this for several emerging technologies such as nanotechnology and synthetic biology (see Leopoldina/Allensbach 2015).

3) These three aspects are drawn from Hampel and Kronberger’s diagnosis in the call for papers for the PACITA 2015 session on “Experiences with Early Engagement Activities”.

4) For more information, see www.synenergene.eu

5) See the “Synthetic Biology Products and Applications Inventory” established by the Woodrow Wilson Center’s Synthetic Biology Project, http://www.synbioproject.org/cpi/.

6) See e.g. the ELSA studies on synthetic biology collected in the database “Synthetic Biology Monitor” (Lorenzet 2015).

Talking about What?, p. 157.

Owen, R./Maenaghten, P./Stilgoe, J. 2012: Responsible research and innovation: From science in society to science for society, with society, in: Science and Public Policy 39, pp. 751-760

Von Schomberg, R. 2011: Prospects for technology assessment in a framework of responsible research and innovation, in: Dusseldorp, M./Beecroft, R. (eds), Technikfolgen abschätzen lehren. Bildungspotenziale transdisziplinärer Methoden, pp. 39-61, Springer VS

Von Schomberg, R. (2013): A Vision of Responsible Research and Innovation, in: Owen, R., Bessant, J., Heintz, M. (eds.): Responsible Innovation. Managing the Responsible Emergence of Science and Innovation in Society. John Wiley, pp. 51-74

Footnotes:

1) Both authors contributed equally to this work.

2) Since 2014 and the 8th Framework Program Horizon 2020, ‘Science in Society’ has changed to ‘Science with and for Society’ with RRI as its core element. For further information about the evolution of the program see the EC website http://ec.europa.eu/research/swafs/index.cfm?pg=about .

3) http://www.nerri.eu/eng/home.aspx

4) The German term ‘Droge’ (‘drug’) does not include pharmaceuticals and is therefore negatively connoted and usually associated with illegal activities.

PART II – Subject Areas of Technology-Assessment Practice

Fostering Responsible Action on the Consumer Side, p. 165.

Aichholzer, G.; Cimander, R.; Kubicek, H., 2013: Can information save energy? A three country comparison of words and actions in participatory local climate protection projects. In: International Journal of Electronic Governance 6/1, pp. 66-85

Aichholzer, G., 2014: E-participation in Local Climate Initiatives. Participants’ Assessments of Process and Impacts. In: T. Michalek, L. Hebáková, L. Hennen, C. Scherz, L. Nierling, J. Hahn (eds.): Technology Assessment and Policy Areas of Great Transitions, Proceedings from the PACITA 2013 Conference in Prague. Prague, pp. 151-157, 390-391

Aichholzer, G.; Kubicek, H.; Torres, L. (eds.), 2016: Evaluating e-Participation. Frameworks, Practice, Evidence. New York: Springer.

Borgstede, C. von, Andersson, K., 2010: Environmental Information – Explanatory Factors for Information Behavior. In: Sustainability 2 (2010), pp. 2785-2798

Carson, L., 2010: Growing up politically: conducting a national conversation on climate change. Australian Policy Online; http://apo.org.au/commentary/growing-politically-conducting-national-conversation-climate-change

Cohen, T. (2012): Can participatory emissions budgeting help local authorities to tackle climate change? In: Environmental Development 2, pp. 18-35

Fischer, C., 2008: Feedback on household electricity consumption: a tool for saving energy? In: Energy Efficiency 1/1, pp. 79–104

Hall, N.; Romanach, L.; Cook, S.; Meikle, S., 2013: Increasing Energy-Saving Actions in Low Income Households to Achieve Sustainability. In: Sustainability 5 (2013), pp. 4561-4577

Peters, M.: Fudge, S.; Jackson, T. (Eds.) 2010: Low Carbon Communities. Imaginative Approaches to Combating Climate Change Locally. Cheltenham, UK; Northampton, MA., USA

Rask, M.; Worthington, R.; Lammi, M. (eds.) 2012: Citizen Participation in Global Environmental Governance. Abingdon/UK, New York/USA

Regniez, G.; Custead, S., 2011: The Role and Effectiveness of Governmental and Non-governmental Communications in Engaging the Public with Climate Change. In: Whitmarsh, L., O’Neill, S., Lorenzoni, I. (eds.): Engaging the Public with Climate Change: Behaviour Change and Communication. London, New York, pp. 200-216

Rubik, F.; Kress, M., 2014: Insights from Municipal Interventions for Influencing the Carbon Footprint of Private-Household Practices. In: Michalek, T.; Hebáková, L.; Hennen, L.; Scherz, C.; Nierling, L.; Hahn, J. (eds.): Technology Assessment and Policy Areas of Great Transitions, Proceedings from the PACITA 2013 Conference in Prague, Prague, pp. 249-255, 402-403

Scott, A.; Oates, C.; Young, W., 2015: A Conceptual Framework of the Adoption and Practice of Environmental Actions in Households. In: Sustainability 7(2015), 5793-5818

Whitmarsh, L.; O’Neill, S.; Lorenzoni, I. (eds.), 2011: Engaging the Public with Climate Change: Behaviour Change and Communication. London, New York

Footnotes:

1) See http://ec.europa.eu/clima/policies/2030/index_en.htm.

2) It was part of the European collaborative research project ‘electronic environmental democracy’ (e2democracy), a three-country cooperation, in Austria funded by the Austrian Science Fund (FWF): I 169-G16. See http://www.e2democracy.eu.

3) All variables are measured on a four-point scale: 1 = “not at all”, … , 4 = “very high”. The scores of the variables were z-transformed first. Values deviating from a scale mean which is set to zero then indicate positive or negative values. The analysis is carried out using the Stata 12 software, applying hierarchical Ward-Clustering using squared Euclidian distances.

Improving Scientific Policy Advice with Respect to Responsible Innovation of Energy Systems, p. 173.

Von Schomberg, R., 2013: A vision of responsible innovation. In: Owen, R.; Bessant, J.; Heintz, M. (eds.): Responsible Innovation. John Wiley, London, pp. 51–74

Droste-Franke, B., 2015: Review of the need for storage capacity depending on the share of renewable energies. in: Moseley, P.; Garche, J. (eds.): Electrochemical Energy Storage for Renewable Sources and Grid Balancing, Elsevier, Amsterdam, pp. 61–86

Droste-Franke, B.; Carrier, M.; Kaiser, M.; Schreurs, M.; Weber, C.; Ziesemer, T., 2015: Improving Energy Decisions. Towards Better Scientific Policy Advice for a Safe and Secure Future Energy System. Ethics of Science and Technology Assessment, Volume 42, Springer, Berlin

Institutional Development and Responsible Innovation in the Transformation of the German Electricity System, p. 179.

Keßler, J 2012: Die Entwicklung der Gemeinde Wolpertshausen zum Bioenergiedorf. Ms. Universität Stuttgart

Randles, L. et al. 2012: A Transatlantic Conversation on Responsible Innovation and Responsible Governance. In: Little by Little, ed. van Lente, H., Coenen, C., Fleischer, T., Konrad, K., Krabbenborg, L., Milburn, C., Thoreau, F. Zulsdorf, T, 169-180. Heidelberg: AKA GmbH and IOS Press, 2012, pp. 169-179

Stehr, N 2007: Die Moralisierung der Märkte. Eine Gesellschaftstheorie. Frankfurt a. M.: Suhrkamp

Keßler, J 2012: Die Entwicklung der Gemeinde Wolpertshausen zum Bioenergiedorf. Ms. Universität Stuttgart

Randles, L. et al. 2012: A Transatlantic Conversation on Responsible Innovation and Responsible Governance. In: Little by Little, ed. van Lente, H., Coenen, C., Fleischer, T., Konrad, K., Krabbenborg, L., Milburn, C., Thoreau, F. Zulsdorf, T, 169-180. Heidelberg: AKA GmbH and IOS Press, 2012, pp. 169-179

Stehr, N 2007: Die Moralisierung der Märkte. Eine Gesellschaftstheorie. Frankfurt a. M.: Suhrkamp

Footnotes:

1) For a more detailed analysis of this case see Keßler 2012.

Diverging Frames under High Voltage, p. 185.

Borup, M.; Brown, N.; Konrad, K.; van Lente, H. 2006: The Sociology of Expectations in Science and Technology. In Technology Analysis & Strategic Management 18 (3/4) (2006), pp. 285–298

Fligstein, N.; McAdam, D., 2011: Towards a General Theory of Strategic Actions Fields. In Sociological Theory 3(2011), pp. 1-26

Goffman, E. 1974: Frame Analysis. An Essay on the Organization of Experience. Northeastern University Press. Boston

Hennicke, P., Müller, M., 2006: Weltmacht Energie. Herausforderung für Demokratie und Wohlstand. 2. Auflage. Stuttgart

Mautz, R.; Byzio, A.; Rosenbaum, W., 2008: Auf dem Weg zur Energiewende: Die Entwicklung der Stromproduktion aus erneuerbaren Energien in Deutschland. Universitätsverlag Göttingen, Göttingen

Neukirch, M., 2014: Konflikte um den Ausbau der Stromnetze. Status und Entwicklung heterogener Protestkonstellationen. Stuttgarter Beiträge zur Organisations- und Innovationssoziologie 2014-01

Neukirch, M., 2015: Zwei ökologische Perspektiven auf "Korridor D" – Mehr Netz mit weniger Kohle? In: Politische Ökologie 141, pp. 128-131

Von Schomberg, R., 2013: A Vision of Responsible Research and Innovation. Responsible Innovation: managing the responsible emergence of science and innovation in society 2013, pp. 51-74

Footnotes:

1) Please mind the difference between the adoption of a frame (the mere fact that an actor adopts a frame that – at the first look – does not seem to fit) and the concrete way of using it. This "frame adaption" must be compatible with the actors' other frames.

Advanced Genomics in Health Care?, p. 193.

Almeida, M., 2014: Policy Hearing report (D5.3). Lisbon, PACITA/ ITQB

Expert Working Groups on Public Health Genomics, 2013: Future Panel on Public Health Genomics – Expert Working Group Reports. The Hague, PACITA/Rathenau Instituut

Future Panel on Public Health Genomics, 2014: Genomics in health care – clinical utility, not technical ability (Policy Brief PACITA WP5). In: Second Parliamentary TA Debate. Strengthening technology assessment for policy-making, Lisbon, pp. 9-12

Health Council of the Netherlands, 2015: Next generation sequencing in diagnosis. The Hague

Krom, A.; Stemerding, D., 2014: Future Panel method description (D5.4) The Hague, PACITA/ Rathenau Instituut

Krom, A.; Almeida, M.; Hennen, L.; Leichteris, E.; Sauter, A.; Stemerding, D., Forthcoming: The Future Panel on Public Health Genomics – lessons learnt & future perspectives. In: Klüver, L.; Nielsen, R. Ø.; Jørgensen, M-L. (eds.): Policy-Oriented Technology Assessment Across Europe. Expanding Capacities. Palgrave Pivot, London

Stemerding, D.; Krom, A., 2013: Expert Paper for the Future Panel on Public Health Genomics (D5.1) The Hague, PACITA/ Rathenau Instituut

Stemerding, D.; Krom, A., 2014: Policy Brief on Public Health Genomics (D5.2) The Hague: PACITA/Rathenau Instituut

Footnotes:

1) This paper is informed by a more elaborate account of the PACITA PHG project by Krom et al. (forthcoming).

2) All PACITA PHG documents can be found at: http://www.pacitaproject.eu/public-health-genomics/

Trust in Health Information Systems, p. 199.

Beiyao Zheng, Mark A Hall, Elizabeth Dugan, Kristin E Kidd, and Douglas Levine. 2002. Development of a scale to measure patients' trust in health insurers. Health Serv Res 37 (1)

Dugan, Elizabeth, Felicia Trachtenberg, and Mark A Hall. 2005. Development of abbreviated measures to assess patient trust in a physician, a health insurer, and the medical profession. BMC Health Serv Res 5:64

Gefen, D, E Karahanna, and D W Straub. 2003. Inexperience and experience with online stores: The importance of TAM and trust. Engineering Management, IEEE Transactions on 50 (3): 307-321

Giddens, Anthony. 1991. The Consequences of Modernity. Stanford, Calif.: Stanford University Press

Hall, M A, E Dugan, B Zheng, and A K Mishra. 2001. Trust in physicians and medical institutions: What is it, can it be measured, and does it matter? Milbank Quarterly 79 (4): 613-639

Hall, Mark A, Fabian Camacho, Elizabeth Dugan, and Rajesh Balkrishnan. 2002a. Trust in the medical profession: Conceptual and measurement issues. Health Serv Res 37 (5). 2002b. Trust in the medical profession: Conceptual and measurement issues. Health Serv Res 37 (5)

Hardin, Russell. 2002. Trust and Trustworthiness. New York: Russell Sage Foundation

Hetherington, Marc J. 2006. Why Trust Matters: Declining Political Trust and the Demise of American Liberalism. Princeton, N.J.; Woodstock: Princeton University Press

Lewis, J. David and Andrew Weigert. 1985. Trust as a social reality. Social Forces 63 (4): 967-985

Lewis, J D and A J Weigert. 2012. The social dynamics of trust: Theoretical and empirical research, 1985-2012. Social Forces 91 (1): 25-31

Luhmann, Niklas. 2000. Familiarity, confidence, trust: Problems and alternatives. In Trust: Making and Breaking Cooperative Relations. Ed. Diego Gambetta. Electronic edition: Department of Sociology, University of Oxford. http://www.sociology.ox.ac.uk/papers/luhmann94-107.pdf

Mayer, Roger C, James H Davis, and F David Schoorman. 1995. An integrative model of organizational trust. The Academy of Management Review 20 (3): 709-734

Mizrachi N, Drori I, and Anspach R. Repertoires of Trust: The Practice of Trust in a Multinational Organization amid Political Conflict. American Sociological Review. 2007;72(1):143-165

Platt J, Kardia SL. Public trust in health information sharing: Implications for biobanking and electronic health record systems. Journal of Personalized Medicine 2015, Feb;5(1)

Rajesh, Balkrishnan, Elizabeth Dugan, Fabian T Camacho, and Mark A Hall. 2003. Trust and satisfaction with physicians, insurers, and the medical profession. Medical Care 41 (9): 1058-1054

New and Emerging Health Technologies. Reflection on the Challenges for HTA, p. 207.

Alemzadeh, Homa, Ravishankar K Iyer, Zbigniew Kalbarczyk, Nancy Leveson, and Jai Raman. 2015. Adverse Events in Robotic Surgery : A Retrospective Study of 14 Years of FDA Data

Banta, David. 2009. "What Is Technology Assessment?" International Journal of Technology Assessment in Health Care 1 (25): 7–9

Banta, David, and Egon Jonsson. 2009. "History of HTA: Introduction." International Journal of Technology Assessment in Health Care 25 Suppl 1 (July): 1–6

Granados, Alicia, Egon Jonsson, H. David Banta, Lisa Bero, Ann Bonair, Mme. Camille Cochet, Nick Freemantle, et al. 1997. EUR-ASSESS Project Subgroup Report on Dissemination and Impact

Hennen, Leonhard. 2004. “Biomedical and Bioethical Issues in Parliamentary TA and in Health Technology Assessment.” Poiesis & Praxis: International Journal of Technology Assessment and Ethics of Science 2 (2-3): 207–20

Maia, Maria João, and Bettina Krings. 2015. “Robots in Surgery: Transformation of Work in the Operating Room.” In Practices of Innovation and Responsability: Insights from Methods, Governance and Action, edited by D. M. Bowman et al. 111–28. Berlin: AKA Verlag

Mowatt, G, D J Bower, J A Brebner, J A Cairns, A M Grant, and L McKee. 1996. “When and How to Assess Fast-Changing Technologies: A Comparative Study of Medical Applications of Four Generic Technologies.” Health Technology Assessment (Winchester, England) 1 (14): i – vi, 1–149

Oortwijn, Wija, Rob Reuzel, and Michael Decker. 2004. “Introduction.” Poiesis & Praxis: International Journal of Technology Assessment and Ethics of Science 2: 97–101

Røttingen, John-Arne, Ansgar Gerhardus, and Marcial Velasco Garrido. 2008. “Future Challenges for HTA in Europe.” In Health Technology Assessment and Health Policy-Making in Europe, 160–81. WHO Regional Office Europe

Schot, Johan, and Arie Rip. 1997. “The Past and Future of Constructive Technology Assessment” Technological Forecasting and Social Change 54 (1996): 251–68

Wolbring, Gregor. 2005. HTA Initiative #23 The Triangle of Enhancement Medicine, Disabled People, and the Concept of Health: A New Challenge for HTA, Health Research, and Health

Footnotes:

1) http://www.inahta.org/

2) See for instance: Velasco Garrido, Marcial, Ansgar Gerhardus, John-Arne Røttingen, and Reinhard Busse. 2010. “Developing Health Technology Assessment to Address Health Care System Needs.” Health Policy (Amsterdam, Netherlands) 94 (3): 196–202.

3) See for instance: Gallo, Pedro. 2004. “Integrating Ethical Enquiry and Health Technology Assessment: Limits and Opportunities for Efficiency and Equity.” Poiesis & Praxis: International Journal of Technology Assessment and Ethics of Science 2: 103–17; Oortwijn, Wija, Rob Reuzel, and Michael Decker. 2004. “Introduction.” Poiesis & Praxis: International Journal of Technology Assessment and Ethics of Science 2: 97–101; Hofmann, Bjørn. 2014. “Why Not Integrate Ethics in HTA : Identification and Assessment of the Reasons.” GMS Health Technology Assessment 10: 1–9.

4) See Lehoux, Pascale. 2006. The Problem of Health Technology. New York: Routledge Taylor and Francis Group.

5) See project “traumaPod7” at https://www.sri.com/work/projects/trauma-pod.

6) For exemple see: Zhu, D., Liu, F., Ma, L., Liu, D., & Wang, Z. (2013). Nanoparticle-Based Systems for T1-Weighted Magnetic Resonance Imaging Contrast Agents. International Journal of Molecular Sciences, 14(5), 10591–10607; Chen, W., Cormode, D. P., Fayad, Z. A., & Mulder, W. J. M.

7) For more information on this topic please read: Nijboer, F., Matuz, T., Kubier, A., & Birbaumer, N. (2006). Ethical, psychological and social implications of brain-computer interface application in paralyzed patients. Bioethics, WS-06-09, 48–50.

Seeing Again. Ageing, Personhood and Technology, p. 213.

Brittain, K.R.; Corner, L.; Robinson, L.; Bond, J., 2010: Ageing in Place and Technologies of Place. In: Sociology of Health & Illness 32 (2010), pp. 272-287

Domínguez-Rué, E.; Nierling, L., 2015 (forthcoming): Ageing and Technology. Perspectives from the Social Sciences. Bielefeld

Glascock, A.P.; Kutzik, D.M., 2006: The Impact of Behavioral Monitoring Technology on the Provision of Health Care in the Home. In: Journal of Universal Computer Science 12 (2006), pp. 59-78

Ihde, D., 1990: Technology and the Lifeworld. From Garden to Earth. Bloomington

Kamphof, I., 2015 (forthcoming): A Modest Art. Securing Privacy in Technologically Mediated Homecare. In: Foundations of Science DOI :10.1007/s10699-015-9448-5

Kenner, A., 2008: Securing the Elderly Body: Dementia, Surveillance and the Politics of “Aging in Place”. In: Surveillance & Society 5 (2008), pp. 252-269

Kitwood, T., 1997: Dementia Reconsidered. The Person Comes First. Buckingham

Pols, J., 2012: Care at a Distance. On the Closeness of Technology. Amsterdam

Schön, D., 1983: The Reflective Practitioner. How Professionals Think in Action. New York

Swierstra, T., 2013: Nanotechnology and Technomoral Change. In: Ethics & Politics 15/1 (2013), pp.200-219

Footnotes:

1) An extended version of this article will appear in Domínguez-Rué/Nierling (2015).

About the Attraction of Machine Logic. The Field of Elderly Care, p. 217.

Bijker, W.; Hughes, T.P.; Pinch, T.J. (eds.), 1987: The social construction of technological systems. New directions in the sociology and history of technology. Cambridge, Massachusetts

Grunwald, A., 2010: Technikfolgenabschätzung – eine Einführung. Berlin

Hülsken-Giesler, M., 2008: Der Zugang zum Anderen. Zur theoretischen Konstruktion von Professionalisierungsstrategien pflegerischen Handelns im Spannungsfeld von Mimesis und Maschinenlogik. Osnabrück

Krings, B.-J.; Böhle, K.; Decker, M.; Nierling, L.; Schneider, C., 2014: Serviceroboter in Pflegearrangements. In: Decker, M.; Fleischer, T.; Schippl, J.; Weinberger, N. (Hg.): Zukünftige Themen der Innovations- und Technikanalyse: Lessons learned und ausgewählte Ergebnisse. Karlsruhe: KIT Scientific Publishing 2014, pp. 63 121 (KIT Scientific Reports 7668)

Mitchell, G., 2001: Pictures of Paradox: Technology, Nursing and Human Science: In: Locsin, R.C. (ed.): Advancing Technology, Caring and Nursing. Westport, Connecticut, pp. 22 40

Mol, A.; Moser, I.; Pols, J. (eds.), 2010: Care in Practice. On Tinkering in Clinics, Homes and Farms. Bielefeld

Statistisches Bundesamt 2011: Demografischer Wandel in Deutschland. Heft 1: Bevölkerungs- und Haushaltsentwicklung im Bund und in den Ländern. Wiesbaden

Footnotes:

1) The project MOVEMENZ (Mobile, self-determined living for people with dementia in the neighborhood, 2014-2015) is funded by the German Ministry of Education and Research. The goal is the development of specifications for mobile technologies to provide the infrastructural preconditions and conceptual standards that allow people with dementia to move as freely as possible in their neighborhood according to their individual needs and requirements. The course of this preliminary project follows a demand-oriented technology development and analyzes the needs of potential users of technical support considering the respective actors in the care process (dementia patients, relatives, professional caregivers, service providers, etc.) and in the neighborhood (store owners etc.). The empirical demand analysis then deduces the need for a technical tool and a social intervention from these different expectations to meet as many of the requirements of the actors in the triangle of care and the neighborhood as possible. This procedure consequently implements the idea of social innovation where a technical innovation is analyzed in its context of use (see http://www.itas.kit.edu/english/iut_current_deck14_movemenz.php, 26.06.20015).

Values or Technologies – Chicken or Egg, p. 223.

Bechtold, U.; Tingas, A., 2012: Scenario Analysis Report: Deliverable 5.3 of the Marie Curie Project Value Ageing. Institut für Technikfolgen-Abschätzung (ITA): Wien

Feenberg, A., 2010: Ten Paradoxes of Technology. In: Technē 14/1 (2010), pp. 3-15

Ganascia, J.G., 2010: The generalized sousveillance society. In: Social Science Information 49/3 (2010), pp. 489-507

Kocka, J.; Staudinger, U.M., 2009: Gewonnene Jahre: Empfehlungen der Akademiengruppe Altern in Deutschland. Deutsche Akademie der Naturforscher Leopoldina. Stuttgart; http://www.leopoldina.org/fileadmin/redaktion/Politikberatung/pdf/Gewonnene_Jahre.pdf (download 5.5.15)

Mantovani, E., 2012: Scenario Generation and Validation. Deliverable 5.2 of the Marie Curie Project Value Ageing; http://www.valueageing.eu/wpcontent/uploads/2012/02/D5.2_SCENARIO_GENERATION_AND_VALIDATION.pdf (download 5.5.15)

Szénay, M., 2014: D 7.2 – Comparative report - Citizen Meetings; http://surprise-project.eu/dissemination/research-results/ (download 5.5.15)

Tingas, A., 2013: Final Report of WP5, DELIVERABLE D5.4.1 of the Marie Curie Project Value Ageing. Rome INNOVA

Von Schomberg, R., 2013: A vision of responsible research and innovation. In: Owen, R.B.J.; Heintz, M. (eds.): Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society. London, pp. 51-75

Big Data: Trends, Opportunities and Challenges, p. 229.

Parliamentary Office of Science and Technology, 2014, POSTnotes 460, 468-474 http://www.parliament.uk/mps-lords-and-offices/offices/bicameral/post/work-programme/big-data/

Kroes, N., 2013, Speech at the EIT Foundation Annual Innovation Forum, Brussels. http://europa.eu/rapid/press-release_SPEECH-13-261_en.htm

IDC, 2014, The Digital Universe of Opportunities. http://www.emc.com/leadership/digital-universe/2014iview/executive-summary.htm

Cebr, 2012, Data Equity: Unlocking the value of big data

SAS and Tech Partnership, 2014, Big Data Analytics Assessment of Demand for Labour and Skills 2013–2020. http://www.thetechpartnership.com/globalassets/pdfs/bigdata_report_nov14.pdf

Executive Office of the President, The White House, 2014, Big Data: Seizing Opportunities, Preserving Values. http://www.whitehouse.gov/sites/default/files/docs/big_data_privacy_report_may_1_2014.pdf

European Commission, 2015, Fact Sheet, Data Protection Day 2015: Concluding the EU Data Protection Reform essential for the Digital Single Market. http://europa.eu/rapid/press-release_MEMO-15-3802_en.htm

"If I Only Knew Now What I Know Then…", p. 233.

Anderson, C. (2008): The End of Theory: The Data Deluge Makes the Scientific Method Obsolete. in wired, June 23 2008, http://www.wired.com/science/discoveries/magazine/16-07/pb_theory

Boellstorff, T. (2013): Making big data, in theory. In: First Monday Vol. 18, No. 10

Boyd, D., Crawford, K. (2012): Critical Questions For Big Data: Provocations for a Cultural, Technological, and Scholarly Phenomenon." In: Information, Communication & Society, Vol. 15(5), pp. 662-679

Casey, G. (1992): Wittgenstein: World, Reality and States of Affairs. In: Philosophical Studies Vol. 33, pp. 107-111

Cukier, K., Mayer-Schönberger, V., (2013): Big Data: A Revolution That Will Transform How We Live, Work and Think. Houghton Mifflin Harcourt

Gartner Group (2001): 3D Data Management: Controlling Data Volume, Velocity and Variety, http://www.gartner.com/it-glossary/big-data/

Lazer, D. , Kennedy, R., King, G., Vespignani, A., (2014): The Parable of Google Flu: Traps in Big Data Analysis. In: Science Magazine, Vol. 343 no. 6176, pp. 1203-1205

Lyon, D. (2014): Surveillance, Snowden, and Big Data: Capacities, Consequences, Critique. in: Big Data & Society July-Sept. 2014, pp. 1-13.

Taleb, N. N., (2007): Black swan: the impact of the highly improbable. Random House

Perry, W. L., McInnis, B., Price, C. C., Smith, S. C., Hollywood, J. S. (2015): Predictive Policing: The Role of Crime Forecasting in Law Enforcement Operations

Strauß, S., Nentwich, M. (2013): Social network sites, privacy and the blurring boundary between public and private spaces, Science and Public Policy 40 (6), pp. 724-732

Footnotes:

1) http://en.wikipedia.org/wiki/MapReduce

2) Wittgenstein's original sentence 1.1 is "Die Welt ist die Gesamtheit der Tatsachen, nicht der Dinge" (Tractatus logico-philosophicus).

3) This contribution is an abridged and focused version of an article the author wrote about datafication for Information issue 6/2015. For further references see that article.

How Should We Govern the Algorithms that Shape Our Lives?, p. 237.

Biermann, 2011: Was Vorratsdaten über uns verraten, Zeit Online (Feb 24 2011), http://www.zeit.de/digital/datenschutz/2011-02/vorratsdaten-malte-spitz (accessed: Jul 25 2015)

Danaher, 2014: Rule by Algorithm? Big Data and the Threat of Algocracy, Blog: Philosophical Disquisitions, http://philosophicaldisquisitions.blogspot.se/2014/01/rule-by-algorithm-big-data-and-threat.html (accessed: Feb 10 2015)

Gillespie, 2014: Algorithm, Culture Digitally (June 25 2014), http://culturedigitally.org/2014/06/algorithm-draft-digitalkeyword/ (accessed: Feb 12 2015)

Manovich, 2013: The Algorithms of Our Lives, The Chronicle of Higher Education, The Chronicle Review (Dec 16, 2013), http://chronicle.com/article/The-Algorithms-of-Our-Lives-/143557/ (accessed: Jul 25 2015)

Morozov, 2013: The Real Privacy Problem, MIT Technology Review (Oct 22, 2013), http://www.technologyreview.com/featuredstory/520426/the-real-privacy-problem/ (accessed: Feb 10 2015)

Stanley, 2014: Chicago Police "Heat List" Renews Old Fears About Government Flagging and Tagging, American Civil Liberties Union (Feb 25 2014), https://www.aclu.org/blog/chicago-police-heat-list-renews-old-fears-about-government-flagging-and-tagging (accessed: Feb 17 2015)

Wagner, 2015: The Ethics of Algorithms: from radical content to self-driving cars, Centre For Internet and Human Rights, https://cihr.eu/publication-the-ethics-of-algorithms/ (accessed: Jul 25 2015)

Assessing Big Data. Results and Experiences from Germany, p. 243.

Boyd, D., Crawford, K. (2011). Six Provocations for Big Data. Microsoft Research. Redmond

Boyd, D., Crawford, K. (2012). Critical questions for big data. In: Information, Communication & Society 15(5), pp. 662–679

Degli Esposti, S. (2014). When big data meets dataveillance: the hidden side of analytics. In: Surveillance & Society, 12(2), pp. 209-225

Ginsberg, J., Mohebbi, M.H., Patel, R.S., Brammer, L., Smolinski, M.S., Brilliant, L. (2009). Detecting influenza epidemics using search engine query data. In: Nature 457(7232), pp. 1012–1014

Richards, N. M., & King, J. H. (2013). Three paradoxes of big data. In: Stanford Law Review Online, 66(4), pp. 41-46

Lazer, D., Kennedy, R., King, G., Vespignani, A. (2014). Big data. The parable of Google Flu: traps in big data analysis. In: Science (New York, N.Y.) 343(6176), pp. 1203–1205

Leimbach, T., Bachlechner, D. (2014). Big Data in der Cloud. TAB-Hintergrundbericht. Berlin

Morozov, E. (2013). To save everything, click here. The folly of technological solutionism. New York City

OECD (2013). New Sources of Growth: Knowledge-Based Capital. Key Analyses and Policy Conclusions. Paris

Pariser, E. (2011). The filter bubble: What the Internet is hiding from you. London

Robotics Technology Assessment: New Challenges, Implications and Risks, p. 249.

Brynjolfsson, E. and A. McAfee (2011). Race against the Machine. Lexington, Digital Frontier Press

Colgate, J.; Wannasuphoprasit, W. and Peshkin, M. (1996), Cobots: Robots for collaboration with human operators, Proceedings of the International Mechanical Engineering Congress and Exhibition (GA DSC), 58 (1996), 433-439

Decker, M. (2014), Who is taking over? Technology assessment of autonomous (service) robots. In: Funk, M.; Irrgang, B. (org.): Robotics in Germany and Japan. Philosophical and technical perspectives. Frankfurt: Peter Lang, pp. 91-110

Decker, M. (2012), Service robots in the mirror of reflective research. Poiesis & Praxis 9 (3-4), pp. 181-200, DOI: 10.1007/s10202-012-0111-8

Frey, C. B. and M. A. Osborne (2013). The future of employment: How susceptible are jobs to computerisation? Oxford

Hinds, P.J.; Roberts, T.L. and Jones, H. (2004). Whose Job Is It Anyway? A Study of Human-Robot Interaction in a Collaborative Task, Human–Computer Interaction, 19:1-2, 151-181

International Federation of Robotics-IFR (2013), World Robotics 2013, IFR

Krings, B.-J. et al. (2014), Serviceroboter in Pflegearrangements. In: Decker, M. et al. (org.): Zukünftige Themen der Innovations- und Technikanalyse: Lessons learned und ausgewählte Ergebnisse. Karlsruhe: KIT Scientific Publishing, pp. 63-121

Moniz, A.B. (2015), Intuitive Interaction Between Humans and Robots in Work Functions at Industrial Environments: The Role of Social Robotics, in Vincent, J. et al., Social Robots from a Human Perspective, Heidelberg, Springer International Publishing, pp. 67-76 (DOI 10.1007/978-3-319-15672-9_6)

Moniz, A.B. (2014) Organisational Challenges of Human–Robot Interaction Systems in Industry: Human Resources Implications, in Machado, C. and Davim, J.P., Human Resource Management and Technological Challenges: Management and Industrial Engineering, Springer, pp. 123-131

Policy Making in a Complex World, p. 253.

Acar, W.; Druckenmiller, D., 2006: Endowing cognitive mapping with computational properties for strategic analysis, Futures 38:993-1009

Cornwall, A., 2002: Making spaces, changing places: Situating participation in development. Institution of Development Studies, IDS Working Paper 170

Fernandez, M.; Wandöfer, T.; Allen, B.; Elisabeth Cano, A.; Alani, H., 2014: Using Social Media To Inform Policy Making: To whom are we listening?. In Proceedings of the European Conference on Social Media (ECSM). UK

Fung, A., 2006: Varieties of Participation in Complex Governance, Public Administration Review, Vol. 66, 2006, pp. 66-75

Gaventa, J.; Barrett, G., 2012: Mapping the outcomes of citizen engagement. World Development 40 (12), 2399-2410

Lindblom, C., 1968: The Policy-making Process, Prentice-Hall, Englewood Cliffs NJ

Franco, L. A. and Montibeller, G. (2010). Facilitated modelling in operational research. European Journal of Operational Research 205: 489-500

Reed, 2008: Stakeholder participation for environmental management: a literature review, Biol. Conserv., 141 (10) (2008), pp. 2417–2431

Saif, H.; Fernandez, M.; He, Y.; Alani, H., 2013: Evaluation datasets for twitter sentiment analysis a survey and a new dataset, the sts-gold. In Proceedings, 1st Workshop on Emotion and Sentiment in Social and Expressive Media (ESSEM) in conjunction with AI*IA Conference, Turin, Italy, 2013

Saif, H.; Fernandez, M.; He, Y.; Alani, H., 2014a: On Stopwords, Filtering and Data Sparsity for Sentiment Analysis of Twitter. In Proc. 9th Language Resources and Evaluation Conference (LREC), Reykjavik, Iceland, 2014

Saif, H.; Fernandez, M.; He, Y.; Alani, H., 2014b: SentiCircles for Contextual and Conceptual Semantic Sentiment analysis of Twitter. Extended Semantic Web Conference (ESWC), Crete, 2014

Saif, H.; Fernandez, M.; He, Y.; Alani, H., 2014c: Adapting Sentiment Lexicons using Contextual Semantics for Twitter Sentiment Analysis. In Proceeding of the first semantic sentiment analysis workshop: conjunction with the eleventh Extended Semantic Web conference (ESWC). Crete, Greece

Saif, H.; Fernandez, M.; He, Y.; Alani, H., 2014d: Semantic Patterns for Sentiment Analysis of Twitter, The 13th International Semantic Web Conference (ISWC), Riva del Garda - Trentino Italy

Turnhout, E.; van Bommel, S.; Aarts, N., 2010: How participation creates citizens: Participatory governance as performative practice. Ecology and Society, 15(4), 26

Footnotes:

1) Cp. URL: http://www.sense4us.eu/ (Retrieved on 01/07/2015)

Factors Influencing Citizens' Attitudes Towards Surveillance-Oriented Security Technologies, p. 259.

Bord, R.J.; O'Connor, R.E., 1992: Determinants of risk perceptions of a hazardous waste site. In: Risk Anal. 12 (1992), pp. 411-416

Finn, R.L.; Wright, D., et al., 2013: Seven types of privacy. In: Gutwirth, S. et al. (eds.): European Data Protection: Coming of Age. Dordrecht, pp. 3-32

Friedewald, M.; van Lieshout, M., et al., 2015a: Privacy and Security Perceptions of European Citizens: A Test of the Trade-off Model. In: Camenisch, J. et al. (eds.): Privacy and Identity 2014, IFIP AICT, vol. 457. Heidelberg, Berlin, pp. 39-53

Friedewald, M.; van Lieshout, M., et al., 2015b: Report on statistical analysis of survey results. PRISMS Deliverable 10.1. http://prismsproject.eu (download 15 September 2015)

General Secretariat of the Council, 2010: Internal security strategy for the European Union: Towards a European security model. Luxembourg

King, G.; Wand, J., 2007: Comparing Incomparable Survey Responses: Evaluating and Selecting Anchoring Vignettes In: Politic. Anal. 15 (2007), pp. 46-66

Lagazio, M., 2012: The evolution of the concept of security. In: Thinker 43/9 (2012), pp. 36-43

Pavone, V.; Esposti, S.D., 2012: Public assessment of new surveillance-oriented security technologies: Beyond the trade-off between privacy and security. In: Public Underst. Sci. 21/5 (2012), pp. 556-572

Székely, I., 2010: Changing Attitudes in a Changing Society? Information Privacy in Hungary, 1989-2006. In: Zureik, E. et al. (eds.): Surveillance, Privacy, and the Globalization of Personal Information: International Comparisons. Montreal, Kingston, pp. 150-170

Verfaillie, K.; van den Herrewegen, E., et al., 2013: Public assessments of the security/privacy trade-off: A criminological conceptualization. PRISMS Deliverable 4.1. http://prismsproject.eu (download 15 September 2013)

Footnotes:

1) PRISMS is co-funded from the European Union's 7th Framework Programme under grant agreement 285399.

2) Croatia had not acceded to the EU at the time of the project planning.

3) Apart from the vignette-related questions, the survey also collected a large number of demographic variables (age, sex, education, geographic region, political orientation, internet experience, and many more) that were used to extract the defining factors.

Annex: The vignettes:

1. Foreign government surveillance. An international disaster relief charity has been sending a monthly newsletter by email to its supporters. The people who run the charity find out through the media that a foreign government has been regularly capturing large amounts of data on citizens of other countries by monitoring their emails. The foreign government says it needs to monitor some communications to help keep its citizens safe and that the main purpose is to focus on terrorism. The charity's officials are unsure whether this means their supporters' personal information is no longer confidential.

2. School access by biometrics. At a local primary school a new system for getting into the school has been installed. All pupils, teachers, parents, other family members, and other visitors have to provide their fingerprints on an electronic pad to identify themselves in order to enter or leave the school.

3. Usage of smart meter data. A power company has decided to offer smart meters to all its consumers. Smart meters enable consumers to use energy more efficiently by allowing them to see how much they are using through a display unit. The data recorded by smart meters allows power companies to improve energy efficiency and charge lower costs. They also enable power companies to build up a more detailed picture of how their customers use energy. It also enables the companies to find out other things, like whether people are living at the address, or how many people are in the household.

4. Monitoring terrorist website visits. A student is doing some research on extremism and as part of his work he visits websites and online forums that contain terrorist propaganda. When his parents find out they immediately ask him to stop this type of online research because they are afraid security agencies such as the police or anti-terrorism bodies will find out what he has been doing and start to watch him.

5. Speed control in neighbourhoods by automatic number plate recognition (ANPR). Michael lives in a suburban neighbourhood where his children like to play outside with their friends. However, his street is a short cut for commuters who drive faster than the speed limit. In response to complaints from residents, the local authority decides to install automatic number plate recognition systems, which identify and track all vehicles and calculate their average speed. This allows those who drive too fast can to be prosecuted.

6. Internet Service Provider (ISP) Data. Companies offering services on the Internet want to sell information about their customers' Internet use to advertisers and other service providers so the information can be used to create more personal offers and deals. This would include the searches you conduct and the websites you visit. Your provider says the information they sell will be anonymous.

7. Use of DNA databases by police. James voluntarily provided a sample of his DNA to a company that carries out medical research. DNA contains the genetic pattern that is uniquely characteristic to each person. He then learns that the research company has been asked to disclose all their DNA samples to police for use in criminal investigations. Samples of DNA can be used to understand potential health problems but also to identify people and to make inferences about who they are related to.

8. Crowd surveillance by police. Version a "Demonstration": Claire is an active member of an environmental group, and is taking part in a demonstration against the building of a new nuclear plant. The police monitor the crowd in various ways to track and identify individuals who cause trouble: they use uniformed and plain-clothes police, CCTV (closed circuit television, i.e. video surveillance), helicopters and drones, phone tapping, and try to find people on social media. V***ersion b "Football":*** David is a football fan who regularly attends home matches. The police monitor the crowd in various ways to track and identify individuals who cause trouble: through uniformed police and plain-clothes police, CCTV, by using helicopters and drones, tapping phones, and by trying to find people on social media.

The Security/Privacy Trade-Off, p. 265.

Dratwa, J. (2014). Ethics of security and surveillance technologies. No. 28, EGE Opinion Report

Pavone, V., S. Degli-Esposti, et al. (2015). D 2.4 – Key factors affecting public acceptance and acceptability of SOSTs. SurPRISE - Surveillance, Privacy and Security: A large scale participatory assessment of criteria and factors determining acceptability and acceptance of security technologies in Europe

Report of the Office of the United Nations High Commissioner for Human Rights (2014). The right to privacy in the digital age, United Nations, General Assembly

SurPRISE Consortium (2015). Policy paper and manual. SurPRISE - Surveillance, Privacy and Security: A large scale participatory assessment of criteria and factors determining acceptability and acceptance of security technologies in Europe. J. Čas

World Economic Forum (2014). Global Risks 2014. Geneva. Ninth Edition

Footnotes:

1) SurPRISE - Surveillance, Privacy and Security: A large scale participatory assessment of criteria and factors determining acceptability and acceptance of security technologies in Europe. http://surprise-project.eu/. This project has received funding from the European Union's Seventh Framework Programme for Research and Technological Development under grant agreement no 285492.

Citizens' Engagement in Urban Security Policy. Potential and Limitations, p. 271.

BAG Wohnungslosenhilfe, 2013: Pressemitteilung: Zahl der Wohnungslosen in Deutschland weiter gestiegen. Bielefeld, http://www.bagw.de/de/themen/zahl_der_wohnungslosen/index.html (download 17.05.2015)

Becker, E., 2011: Engagement und Partizipation in der Stadtentwicklung. In: FJSB 24/3 (2011), pp. 76–82

BMFSFJ, 2012: Erster Engagementbericht. Berlin

Bode, I.; Evers, A.; Klein, A. (eds.), 2009: Bürgergesellschaft als Projekt. Eine Bestandsaufnahme zu Entwicklung und Förderung zivilgesellschaftlicher Potenziale in Deutschland. Wiesbaden

Engels, F., 1872[1979]: The Housing Question. Moscow

Foucault, M., 1977: Discipline and Punish. The Birth oft he Prison. New York

Gornig, M.; Goebel, J., 2013: Ökonomischer Strukturwandel und Polarisierungstendenzen in deutschen Stadtregionen. In: Kronauer, M.; Siebel, W. (eds.): Polarisierte Städte: Soziale Ungleichheit als Herausforderung für die Stadtpolitik. Frankfurt a.M.; New York, pp. 51–68

Harvey, D., 2012: Rebel Cities. From the Right to the City to the Urban Revolution. London; New York

Hobsbawm, E., 1959: Primitive Rebels. Oxford

Holm, A., 2014: Mietenwahnsinn. Warum Wohnen immer teurer wird und wer davon profitiert. München

Holm, A.; Lebuhn, H., 2013: Die Stadt politisieren – Fragmentierung, Kohärenz und soziale Bewegungen in der "Sozialen Stadt". In: Kronauer/Siebel 2013, pp. 194–216

Lefebvre, H., 2003: The Urban Revolution. Minneapolis

Marglin, S.A.; Schor, J.B. (eds.), 1991: The Golden Age of Capitalism. Reinterpreting the Postwar Experience. Oxford

Préteceille, E., 2013: Die europäische Stadt in Gefahr. In: Kronauer/Siebel 2013, pp. 27–50

R+V Versicherung, 2014: Die Ängste der Deutschen 2014. Wiesbaden, https://www.ruv.de/de/presse/download/pdf/aengste-der-deutschen-2014/grafiken-bundesweit.pdf (download 17.05.2015)

Swyngedouw, E., 2009: The Antinomies of the Postpolitical City. In Search of a Democratic Politics of Environmental Production. In: IJURR 33/3 (2009), pp. 601–20

Van Ooyen, R.C., 2006: Community Policing. In: Lange, H.-J. (ed.): Wörterbuch zur Inneren Sicherheit. Wiesbaden, pp. 44–48

Wurtzbacher, J., 2008: Urbane Sicherheit und Partizipation. Wiesbaden

Footnotes:

1) VERSS, Aspekte einer gerechten Verteilung von Sicherheit in der Stadt (The Distribution of Security in Cities: Reflections on Justice), funded by the German Ministry of Education and Research. For more information, see www.verss.de. I would like to thank Regina Ammicht Quinn and Matthias Leese for their helpful comments.

PART III – Technology-Assessment Methods And Concepts

Underestimated Assumptions and Contexts of TA Theories and Practices, p. 279.

Banse, G. (ed.), 2007: Technological and Environmental Policy – Studies in Eastern Europe, Berlin.

Becker, H. A., Vanclay, F. (eds.), 2003: The International Handbook of Social Impact Assessment, Cheltenham, UK – Northampton, MA

Chen, K., Zacher, L. W., 1978: Toward Effective International Technology Assessment, Technological Forecasting and Social Change, vol. 11, no 2, 1978, s. 97-105

Edwards, A. R., 2009: The Sustainability Revolution – portrait of a paradigm shift, Gabriola Island, B.C.

Gamser, M. S. (ed.), 1988: Mobilizing Appropriate Technology, London

Grin, J., Grunwald, A. (eds.), 2000: Vision Assessment: Shaping Technology in 21st Century Society – Towards a Repertoire for Technology Assessment, Berlin

Grin, J., Rotmans, J., Schot, J., 2010: Transitions to Sustainable Development, New York – London

Kumar, S. (ed.), 1981: The Schumacher Lectures, New York

Loorbach, D., 2007: Transition Management – new mode of governance for sustainable development, Utrecht

Mejlgard, M., Stares, S., 2012: Performed and preferred participation in science and technology across Europe: Exploring and alternative idea of "democratic deficit". In: Public Understanding of Science, 22(6), 2011, pp. 660-673

Mulder, K., Ferrer, D., van Lente, H. (eds.), 2011: What is Sustainable Technology – Perceptions, Paradoxes and Possibilities, Sheffield

Petermann, T., Coenen, R. (eds.), 1999: Technikfolgen Abschätzung in Deutschland, Frankfurt – New York

Pont, S. (ed.), 2013: Digital State, London

Porter, A. L., Fittipaldi, J. J. (eds.), 1998: Environmental Methods: Retooling Impact Assessment for the New Century, Fargo, ND

Porter, A. L. et al., 1980: A Guidebook for Technology Assessment and Impact Analysis, New York

Rohracher, H. et al. (eds.), 2007: Governing Sociotechnical Change in Southern Europe. Contributions from a Science & Technology Study Perspective, Sofia

Simonis, G. (ed.), 2013: Konzepte und der Technikfolgen Abschätzung, Wiesbaden

Zacher, L. W., 1980: Premises and Goals of TA in Centrally Planned Economies, In: K. Chen, M. Boroush, A. N. Christakis (eds.), Technology Assessment: Creative Futures, New York, pp. 161-169

Zacher, L. W., 1981: Towards a Democratization of Technological Choices, In: Bulletin of Science, Technology and Society, vol. 1, 1-2, Pergamon Press, pp. 243-251

Zacher, L. W., 1982: Technology and Society as a Subject of Research in Poland, w: P. T. Durbin (ed.), Research in Philosophy and Technology, vol. 5, Greenwich, Conn., pp. 317-329

Zacher, L. W., 1989: Technology Assessment – The Polish Case, IGW – Report über Wissenschaft und Technologie, Heft 4, Nov., pp. 59-67

Zacher, L. W., 1990: Institutionalisierung von TA in Einem Postkommunistischen Land – der Fall Polen, Kassel

Zacher, L. W., 1994: Social Movements as a Part of the TA Process, In: L. W. Zacher (ed.) Understanding the Contemporary World – Inquiries into the Global, Technological and Ecological Issues, Warsaw

Zacher, L. W., 1996: Chances of Modernization in Post-Communist Countries, Journal of International Studies, Vol. 4, No. 3, Summer, pp. 64-93

Zacher, L. W., 2006: E-Transformations of Societies, In: Encyclopedia of Digital Government, vol. II, Hershey – London – Melbourne – Singapore, pp. 756-762

Zacher, L. W., 2012a: Society, Market and Technology Nexus as Contexts of ICT Policies and Applications: Some Issues and Reflexions, In: International Journal of Information – Communication Technologies and Human Development, July – September, Vol. 4, No. 3, pp. 32-42

Zacher, L. W., 2012b: Technological vs. Political Modernization – Interactions and Feedbacks, In: I. Modi (ed.), Modernization, Globalization and Social Transformation, Jaipur, pp. 90-101

Zacher, L. W., 2012: Toward Democratization of Science and Technology Spheres. Some Opportunities and Problems, In: A. Bammé et al. (eds), Yearbook 2011 of the IAS-STS, Munich-Vienna, pp. 165-187

Zacher, L. W., 2015: Digital Future(s), In: Encyclopedia of Science and Technology, 3 ed., Hershey, PA 2015, IGI Global, pp. 3735-3741

Technology Assessment in East Asia. Experience and New Approaches, p. 287.

Büscher, C. (2015) Global Pressure – Local Transition: The German "Energiewende" as an Interdisciplinary Research Problem in the Helmholtz Alliance ENERGY-TRANS, in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Chang, Y-B. and Han, J-K. (2009) Participatory science and technology policy-making in Korea: a critical assessment, presented at Atlanta Conference on Science and Innovation Policy

Chen, D-S. and Deng, C-Y. (2007) Interaction between citizens and experts in public deliberation: a case study of consensus conferences in Taiwan, East Asian Science, Technology and Society: An International Journal 1(1): 77-97

Delvenne, P., Charlier, N, Rosskamp, B. and Van Oudheusden, M. (2015) De- and Re-Institutionalizing

Technology Assessment in Contemporary Knowledge-Based Economies: A Side-by-Side Review of Flemish and Walloon Technology Assessment, , TATuP, Technikfolgenabschätzung – Theorie und Praxis 1(24), February 2015: 20-28

Ely, A., van Zwanenberg, P. and Stirling, A. (2014) Broadening out and opening up technology assessment: approaches to enhance international development, co-ordination and democratisation. Research Policy 43(3): 505-518

Escaith, H. and Inomata, S. (2011), Trade patterns and global value chains in East Asia: From trade in goods to trade in tasks, Geneva, IDE-JETRO and World Trade Organization

Genus, A. and Coles, A.-M. (2008) Rethinking the multi-level perspective of technological transitions, Research Policy 37(9): 1436-1445

Grunwald, A. (2015), Preface, in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Izumi, S. (2015) Preface, in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Jolly, D.R. (2008) Chinese vs. European views regarding technology assessment: convergent or divergent? Technovation 28: 818-830

Kano, S. (2015) Technology Provider and Receiver Interactions: The Capability Threshold Concept and Its Application to Technology Assessment, in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Kim, M. (2002) Cloning and deliberation: Korean consensus conference, Developing World Bioethics

Kobayashi, S. (2015), Technology Assessment Activity at the National Diet Library of Japan, in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Matsuo, M; Kishimoto, A.; Tachikawa, M.; Matsuura, M. (2015) Joint Fact Finding: Bridging the Evidence Gaps in Decision Making, in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Morita, A. (2015) Preface in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Moniz, A.B. and Boavida, N. (2015) Technology Assessment in Non-PTA Countries: An Overview of Recent Developments in Europe, Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)Moniz, A.B. and Okuwada, K., eds. (2015) Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Moniz, A.B. and Okuwada, K. (eds.) (2015) Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

OECD (2013), OECD Science, Technology and Industry Scoreboard 2013: Innovation for Growth, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/sti_scoreboard-2013-en

Russell, A.W., Vanclay, F.M., Salisbury, J.G. and Aslin, H.J. (2011) Technology assessment in Australia: the case for a formal agency to improve advice to policy makers, Policy Sciences 44(2): 157-177

Sato, K. (1985) Historical development of think-tanks (in Japanese), pp. 29-71 in Institute of Journalism, University of Tokyo (ed.) Japanese Think-Tanks. University of Tokyo Press

Scherz, C. and Merz, C. (2015) Parliamentary TA: Lessons to Be Learned from the Established, in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Shiroyama, H. Yoshizawa, G., Matsuo, M. and Hatanaka, R. (2009) Activities without institutionalization: limits and lessons of TA and TA-like activities in Japan, paper presented at the Atlanta Conference on Science and Innovation Policy 2009, Georgia Institute of Technology, USA

Taniguchi, T. (2015) Technology Assessment and Risk Governance: Challenges Ahead in Japan, in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

van Est, R., Ganzevles, J. & Nentwich, M. (2015) Modeling parliamentary technology assessment in relational terms. pp. 17-24 in TA as an Institutionalized Practice: Recent National Developments and Challenges, PACITA

Wakamatsu, Y. (1999) A citizens' conference on gene therapy in Japan: a feasibility study of the consensus conference method in Japan, AI & Society 13(1-2): 22-43

Yarime, M. (2015) Implementing Technology Assessment through Stakeholder Platforms: Strategic Resource Logistics for Socially Robust Models of Sustainability Innovation, in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Yoshizawa, G. (2012) Anticipatory and participatory governance: revisiting technology assessment on nuclear energy in Japan, Journal of Disaster Research 7(Sp): 511-516

Yoshizawa, G. et al. (2014) ELSI practices in genomic research in East Asia: implications for research collaboration and public participation, Genome Medicine 6:39

Yoshizawa, G. (2015) From Intermediary to Intermedia: Technology Assessment (TA) and Responsible Research and Innovation (RRI) in Moniz, A.B. and Okuwada, K. (eds.), Technology Assessment in Europe and Japan, Karlsruhe, KIT Scientific Publishing (forthcoming)

Characteristics of TA Institutions by Agencies and South Korea's Experience, p. 295.

Berloznik, R.; Van Langenhove, L., 1998: Integration of Technology Assessment in R&D Management Practices. In: Technological Forecasting and Social Change 58/1-2 (1998), pp. 23-33

Bucchi, M.; Neresini, F., 2008: Science and Public. In: Hackett, E.J.; Amsterdamska, O.; Lynch, M.; Wajcman, J. (eds.): The Handbook of Science and Technology Studies. Cambridge, pp. 448-472

Cruz-Castro, L.; Sanz-Menéndez, L., 2005: Politics and institutions: European parliamentary technology assessment. In: Technological Forecasting and Social Change 72/4 (2005), pp. 429-448

Enzing, C.; Deuten, J.; Rijnders-Nagle, M.; van Til, J., 2012: Technology across borders - Exploring perspectives for pan-European Parliamentary Technology Assessment. Brussels

Ganzevles, J.; van Est, R. (eds.), 2012: TA Practices in Europe. Deliverable 2.2. PACITA Project, European Commission. Brussels

Kim, B.S., 2012: Institutionalizing Technology Assessment in South Korea. In: Technikfolgenabschätzung – Theorie und Praxis 21 (2012), pp. 80-83

MSIP; KISTEP, 2014: 2013 Technology Assessment in Korea. Seoul

Van Den Ende, J.; Mulder, K.; Knot, M.; Moors, E.; Vergragt, P., 1998: Traditional and Modern Technology Assessment: Toward a Toolkit. In: Technological Forecasting and Social Change 58/1-2 (1998), pp. 5-21

Vig, N.J.; Paschen, H., 2002: Parliaments and Technology. The Development of Technology Assessment in Europe. New York

Why Do Farmers Have a Low Propensity to Adopt Soil Conservation Technologies on the Degraded Steppe Land in South Russia?, p. 301.

Black, A.W., and I. Reeve. 1993. "Participation in Landcare Groups: the Relative Importance of Attitudinal and Situational Factors." Journal of Environmental Management. 39: 51-71

Crabtree, J.R., N. Chalmers, and N.J. Barron. 1998. "Information for policy design: modelling? Participation in a farm woodland incentive scheme." Journal of Agricultural Economics 49: 306-320

Dammann, S., Meinel, T., Beljaev, V.I. and Frühauf, M. 2011. Einfluss verschiedener Bodenbearbeitungsmethoden auf Bodenwasserhaushalt und Pflanzenproduktion in Trockengebieten. Hallesches Jahrbuch für Geowissenschaften, 32/33: 33-48

Defrancesco, E., P. Gatto, F. Runge, and S. Trestini. 2008. "Factors Affecting Farmers' Participation in Agri-environmental Measures: A Northern Italian Perspective." Journal of Agricultural Economics 59 (1): 114-131

Dupraz, P., K. Latouche, and N. Turpin. 2009. "Threshold effect and co-ordination of agri-environmental efforts." Journal of Environmental Planning and Management 52 (5): 613-630

Federal Governmental Service for Cadastral Registration, Cadaster and Cartography. 2013. Doklad o sostojanii i ispolzovanii zemel Altajskovo kraja (Report on the Assets and Land Utilization in Altai Krai) Governmental report. Barnaul

Frühauf, M., Meinel, T. 2007. Desertification in the Agricultural Used Dry Steppes in Central Asia. Proceedings of the International Conference Soil and Desertification – Integrate Research for the Sustainable Management of Soils in Drylands, May 5-6, 2006, Hamburg, Germany

Jolly, R.W., Eleveld, B., McGrann, J.M., Raitt, D.D. 1985. Transferring Soil Conservation Technology to Farmers. In: Follett, R.F. and Stewart, B. A. (eds.): Soil Erosion and Crop Productivity. Soil Erosion and Crop Productivity. American Society of Agronomy: 187-220

López, M.V., Sabre, M., Gracia, R., Arrúe, J.L., Gomes, L. 1998. Tillage effects on soil surface conditions and dust emission by wind erosion in semi-arid Aragón (NE Spain). Soil & Tillage Research 45: 91-105

Lowe, P., and P. Cox. 1990. Technological Change, Farm Management and Pollution Regulation: The Example of Britain. Technological Change and the Rural Environment. David Fulton Publishers

Meinel, T. 2002. Die geoökologischen Folgewirkungen der Steppenumbrüche in den 50er Jahren in Westsibirien. Ein Beitrag für zukünftige Nutzungskonzepte unter besonderer Berücksichtigung der Winderosion. Diss. Martin-Luther-Universität Halle-Wittenberg

Meyer BC, Schreiner V, Smolentseva EN, Smolentsev BA. 2008. Indicators of desertification in the Kulunda Steppe in the south of Western Siberia. Archives of Agronomy and Soil Science 54 (6): 585-603

Morris, C., and C. Potter. 1995. "Recruiting the new conservationists: adoption of agri-environmental schemes in the UK." Journal of Rural Studies 11: 51-63

Polman, N.B.P., and L.H.G. Slangen. 2008. "Institutional design of agri-environmental contracts in the European Union: the role of trust and social capital." NJAS Wageningen journal of life sciences 55 (4): 413-430

ROSSELCHOZ. 2014. Доклад о состоянии и использовании земель сельскохозяйственного назначения. Ministry of agriculture of Russian Federation. Moscow

Skerratt, S. 1998. "Socio-economic evaluation of UK agri-environmental policy: imperatives for change." Agricultural Systems

Sutherland, L.A., D. Gabriel, L. Hathaway-Jenkins, U. Pascual, U. Schmutz, D. Rigby, R. Godwin, S. Sait, R. Sakrabani, B. Kunin, T.G. Benton, and S. Stagl. 2012. "The 'neighbourhood effect': A multidisciplinary assessment of the case for farmer co-ordination in agri-environmental programs." Land Use Policy 29: 502-512

Vanslembrouck, I., G. Van Huylenbroeck, and W. Verbeke. 2002. "Determinants of the Willingness of Belgian Farmers to Participate in Agri-environmental Measures." Journal of Agricultural Economics 53 (3): 489-511

Warriner G.K., and T.M. Moul. 1992. "Kinship and personal communication network influences on the adoption of agriculture conservation technology." Journal of Rural Studies 8 (3): 279-91

Wilson, G.A. and K. Hart 2000. "Financial imperative or conservation concern? EU farmers' motivations for participation in voluntary agri-environmental schemes." Environment and Planning 32 (12): 2161-2185

Wynn, G., B.Crabtree, and J. Potts. 2001. "Modelling farmer entry into the environmentally sensitive area schemes in Scotland." Journal of Agricultural Economics 52 (1): 65-82

Zentner, R.P., Lafond, G.P., Derksen, D.A., Campbell, C.A. 2002. Economics of crop diversification and soil tillage opportunities in the Canadian prairies. Soil & Tillage Research 67: 9-21

Footnotes:

1) We would like to acknowledge funding from the German Ministry of Education and Research (BMBF) to support the German-Russian research project KULUNDA "How to Prevent the Next Global Dust Bowl? Ecological and Economic Strategies for Sustainable Land Management in the Russian Steppes: A Potential Solution to Climate Change".

2) The costs of the equipment (straw chopper) for the old soviet harvesting machine amount to around 2000 euros and of a seeding machine capable of seeding directly into the straw around 100,000 euros. At the same time the annual remuneration of the wage labor in agriculture is around 2,600 euros.

3) Nevertheless, the statistics show that medium and large farms (average size 7,200 hectares) display unfavorable economic conditions. Per hectare figures were (2013): annual total production 10,700 rubles, governmental subsidy 180 rubles, indebtedness 6,800 rubles, resulting in a total indebtedness–production ratio of 63% (ROSSTAT, 2013).

4) Importantly, some relevant governance structures have been already implemented to solve the inherited institutional barriers.

Designing a PhD Programme on TA. An Evaluation of Five Years of Experience, p. 311.

Baumann, M.; Boavida, N.; Maia, M.J.F.; Lichtner, P.; Moniz, A. B. (2012), Renewable energy systems: the theme for the PACITA Summer School on TA, Liége, Belgium, 25.-28.06. Enterprise and Work Innovation Studies (8), 95-101

Boavida, N.; Baumann, M.; Moniz, A. B.; Schippl, J.; Weil, M.; Reichenbach, M. (2013), Technology transition towards e-mobility: technology assessment as a tool for policy design. In: Gerpisa (Org.): Proceedings of the International Colloquium of GERPISA - The International Network of the Automobile. Paris, France, 12.-14.06., publ. online

Boavida, N.; Fleischer, T.; Kuppler, S.; Lösch, A.; Moniz, A. B.; Schippl, J.; Simon, J. (2012), Perspectives on Technology, Society and Innovation. Report on the 4S/EASST Joint Conference "Design and Displacement". Copenhagen, Denmark, Tagungsbericht. Technikfolgenabschätzung - Theorie und Praxis 21(3), 92-95

Böhle, Knud; Moniz, António (2015) : No Countries for Old TechnologyAssessment? Sketching the Efforts and Opportunities to Establish Parliamentary TA in Spain and Portugal, Technikfolgenabschätzung – Theorie und Praxis, Vol. 24, No. 1, pp. 29-44

Coenen, Chr.; Velloso, G.T. (2014), Relevanz der Neurotechnologien und der Enhancement-Aspekt. Presentation at NERRI-Workshops "Enhancement durch neurotechnologische Verfahren? Chancen, Risiken, Visionen", Universität Mainz, 06.-07.10.

Cruz-Castro, L.; Sanz-Menéndez, L. (2004), "Shaping the impact the institutional context of technology assessment" in Decker, M.; Ladikas, M. eds. (2004), Bridges between Science, Society and Policy: Technology Assessment -Methods and Impacts, Berlin, Springer, pp. 101 - 127

Fournier, G.; Lindenlauf, F.; Baumann, M.; Seign, R.; Weil, M. (2014), Carsharing with Electric Vehicles and Vehicle-to-Grid: a future business model? In: Proff, H. (Hrsg.): Radikale Innovationen in der Mobilität - technische und betriebswirtschaftliche Aspekte. Springer-Gabler, 63-79

Grunwald, A. (2007): Converging Technologies: visions, increased contingencies of the conditio humana, and search for orientation. Futures 39(2007), S. 380-392

Joss, S., Belucci, S. (2002) (eds.): Participatory Technology Assessment – European Perspectives. Westminster University Press, 2002

Klüver, L. et al. (2004), "Technology assessment in Europe: Conclusions and wider perspectives" in Decker, M.; Ladikas, M. eds. (2004), Bridges between Science, Society and Policy: Technology Assessment -Methods and Impacts, Berlin, Springer, pp. 87 – 98)

Maia, M.J.F.; Krings, B.-J. (2014a), Robots in surgery contributions from a technology assessment perspective. Presentation at S.NET Conference, 6th Annual Meeting, "Better technologies with no regret?", KIT-ITAS, Karlsruhe, 22.-24.09. 104.195

Moniz, António and Grunwald, Armin (2009): Recent Experiences and Emerging Cooperation Schemes on TA and Education: An Insight into Cases in Portugal and Germany, TATuP Technikfolgenabschätzung – Theorie und Praxis, Vol. 18, No. 3 (2009): pp. 17-24 [http://ideas.repec.org/p/pra/mprapa/19519.html]

Moniz, A. B.; Krings, B.-J. (2014b) Technology assessment approach to human-robot interactions in work environments. In Proceedings of Human System Interaction (HIS) 7th International Conference, IEEE Xplore, pp. 282-289 (DOI: 10.1109/HSI.2014.6860490)

Moniz, A. B.; Krings, B.-J. (2014), Social innovation aspects of human-robot interaction in manufacturing. Presentation at the XVIII World Congress of Sociology-RC30 Sociology of Work. Yokohama, Japan, 16.07.

Moniz, A. B.; Maia, M.J.F.; Krings, B.-J.; Decker, M. (2014), Technology Assessment (TA) of Human-Robot Interaction (HRI) in Complex Working Systems (CWS). Poster at Horizon 2020 LEIT ICT National Expert Group 23 and 24 "Robotics Information Day". Luxembourg, 13.-14.01.

Moretto, S.M.; Palma, A.P.; Moniz, A. B. (2012), Constructive technology assessment in railway: The case of high-speed train industry. International Journal of Railway Technology 1(3), 73-95

Moretto, S.; Robinson, D.; Moniz, A. Brandão; Chen, S. (2014), Mind the gap in high-speed trains futures: A methodological contribution (Paper 195), 5th FTA Future-oriented Technology Analysis Conference, Brussels, publ. online, Doi: 10.4203/ccp

Seitz, S.B.; Maia, M.J.F.; Velloso, G.T. (2013), Once you have a hammer ... - Second PACITA Practitioners' Meeting - Workshop on TA methods. Tagungsbericht. Technikfolgenabschätzung - Theorie und Praxis 22(3), 81-83

Footnotes:

1) Available at http://ideas.repec.org/s/ieu/wpaper.html and http://sites.fct.unl.pt/iet/book/iet-working-papers-series.

openTA – A Web Portal Requiring Commitment, p. 317.

Böhle, K., 2014: Technikfolgenabschätzung als Gegenstand sozialwissenschaftlicher Literatur. Eine annotierte Bibliografie deutschsprachiger Quellen von 1978 bis 2013. Köln: GESIS-Leibniz Institut für Sozialwissenschaften. ISSN: 1866-5810 (Print) 1866-5829 Online); https://www.openta.net/documents/ (download 14.5.15)

Geipel, M. M.; Böhme, C.; Hannemann, J., 2015: Metamorph: A Transformation Language for Semi-structured Data. In: D-Lib Magazine, 21 (2015), no. 5/6;http://www.dlib.org/dlib/may15/boehme/05boehme.html (download 15.6.15)

Nentwich, M.; Riehm, U., 2012: Internationale Fachportale für Technikfolgenabschätzung. Brauchen wir eines oder sogar mehrere? In: Technikfolgenabschätzung – Theorie und Praxis Nr. 3, 21. Jahrgang, pp.. 76-80; https://www.openta.net/documents/ (download 5.2.2015)

Drost-Fromm, I., 2014: Die Über-Suchmaschine. Verteilte Suche mit Elasticsearch. In: c't 10/14, p. 154

Potentials and Challenges of a Prospective Technology Assessment, p. 327.

Collingridge, D., 1980: The social control of technology; St. Martin's Press, New York

Giese, B. et al. (eds.), 2015: Synthetic Biology. Character and Impact; Springer, Berlin/New York

Gleich, A. v., 2004: Technikcharakterisierung als Ansatz einer vorsorgeorientierten prospektiven Innovations- und Technikanalyse. In: Alfons Bora, Michael Decker, Armin Grunwald, Ortwin Renn (eds.): Technik in einer fragilen Welt. Die Rolle der Technikfolgenabschätzung; Sigma, Berlin, pp. 229-244

Grin J., Grunwald, A. (eds.), 2000: Vision assessment. Shaping technology in 21st century society; Springer, Berlin

Grunwald, A., 2012: Synthetische Biologie als Naturwissenschaft mit technischer Ausrichtung. Plädoyer für eine „Hermeneutische Technikfolgenabschätzung". In: Technikfolgenabschätzung, Theorie und Praxis, 21(2), pp. 10-15

Guston, D.H., Sarewitz, D., 2002: Real-time Technology Assessment. In: Technology in Society 24(1/2), pp. 93-109

Liebert, W., Schmidt, J.C., 2010a: Towards a prospective technology assessment: challenges and requirements for technology assessment in the age of technoscience. In: Poiesis & Praxis 7, pp. 99-116

Liebert, W., Schmidt, J.C., 2010b: Collingridge's dilemma and technoscience. An attempt to provide a clarification from the perspective of the philosophy of science. In: Poiesis & Praxis 7(1-2), pp. 55-71

Nordmann, A., 2007: If and Then: A Critique of Speculative NanoEthics. In: NanoEthics, 1(1), pp. 31-46

Zweck, A., 2002: Technologiefrüherkennung. Ein Instrument der Innovationsförderung. In: Wissenschaftsmanagement. Zeitschrift für Innovation, 2, 25-30

Demands and Challenges of a Prospective Technology Assessment, p. 331.

Beecroft, R.; Schmidt, J.C., 2012: Die Szenariomethode in der Technikfolgenabschätzung. Eine didaktische Rekonstruktion für die Interdisziplinäre Technikbildung. In: Dusseldorp, M.; Beecroft, R. (eds.): Technikfolgen abschätzen lehren. Bildungspotenziale transdisziplinärer Methoden. Wiesbaden, 157-176

Bender, W.; Liebert, W.; Schmidt, J.C., 2004: Prospektive Gestaltung von Technik und Wissenschaft. In: Präsident der TU Darmstadt (ed.): Nachhaltige Gestaltung von Technik und Wissenschaft. Schwerpunktthemenheft von TUD Thema Forschung. Darmstadt, 14-22

Bloch, E., 1959: Das Prinzip Hoffnung, Frankfurt (Engl. transl.: The Principle of Hope. Cambridge, MA, 1986)

Collingridge, D., 1980: The social control of technology. New York

Gleich, A. v., 2004: Technikcharakterisierung als Ansatz einer vorsorgeorientierten prospektiven Innovations- und Technikanalyse. In: Bora A.; Decker, M.; Grunwald, A.; Renn, O. (eds.): Technik in einer fragilen Welt. Die Rolle der Technikfolgenabschätzung, Berlin

Grin J.; Grunwald, A. (eds), 2000: Vision assessment. Shaping technology in 21st century society. Berlin

Grunwald, A., 2002: Technikfolgenabschätzung. Eine Einführung. Berlin

Grunwald, A., 2012: Synthetische Biologie als Naturwissenschaft mit technischer Ausrichtung. Plädoyer für eine "Hermeneutische Technikfolgenabschätzung". Technikfolgenabschätzung, Theorie und Praxis, 21(2), 10-15

Guston, D.H.; Sarewitz, D., 2002: Real-time Technology Assessment. In: Technology in Society 24(1-2), 93–109

Habermas, J., 1991: Erläuterungen zur Diskursethik, Frankfurt, p. 119-226 (Engl. transl.: In: Justification and Application. Remarks on Discourse Ethics. Cambridge, MA, 1993, p. 19-111)

Höffe, O. (ed.): Einführung in die utilitaristische Ethik. 5th edition, Tübingen/Basel 2013

Jonas, H., 1979: Das Prinzip Verantwortung. Frankfurt (Engl. transl.: The Imperative of Responsibility. In Search of an Ethics for the Technological Age. Chicago, 1984)

Liebert, W., 2007: TA globalisierter Technikentwicklung am Fall nuklearer Technologien. In: Bora, A.; Bröchler, S.; De-cker, M. (eds.): Technology Assessment in der Weltgesellschaft. Berlin, 97-107

Liebert, W.; Schmidt, J.C.; Bender, W., 2005: Prospektive Gestaltung von Wissenschaft und Technik – Zum Umgang mit Fragilität und Ambivalenz. In: Bora, A.; Decker, M.; Grunwald, A.; Renn, O. (eds.): Technik in einer fragilen Welt. Die Rolle der Technikfolgenabschätzung. Berlin, 353-362

Liebert, W.; Schmidt, J.C., 2010a: Towards a prospective technology assessment: challenges and requirements for technology assessment in the age of technoscience. In: Poiesis & Praxis 7, 99-116

Liebert, W.; Schmidt, J.C., 2010b: Collingridge's dilemma and technoscience. An attempt to provide a clarification from the perspective of the philosophy of science. In: Poiesis & Praxis 7(1-2), 55-71

Liebert, W.; Schmidt, J.C., 2010c: Governance von Technoscience durch antizipierende Gestaltung. Zugänge durch Pro-TA. In: Aichholzer, G.; Bora, A.; Bröchler, S.; Decker, M.; Latzer, M. (eds.): Technology Governance. Der Beitrag der Technikfolgenabschätzung. Berlin,145-154

Liebert, W.; Schmidt, J.C., 2012: Zukunftswissen und Technikfolgenabschätzung. Die Rolle von Szenariomethoden für eine frühzeitige Technikgestaltung am Beispiel von Energieszenarien. In: Decker, M.; Grunwald, A.; Knapp, M. (eds.): Der Systemblick auf Innovation. Technikfolgenabschätzung in der Technikgestaltung. Berlin, 283-292

Liebert, W.; Schmidt, J.C., 2015: Fundierung von Responsible Research Innovation (RRI) und normative Ansprüche prospektiver Technikfolgenabschätzung. NTA6-TA14 Conf., Wien, 8.9.2014 (to be published)

Schmidt, J.C., 2012: Selbstorganisation als Kern der Synthetischen Biologie. Ein Beitrag zur Prospektiven Technikfolgenabschätzung. In: Technikfolgenabschätzung. Theorie und Praxis 21(2), 29-35

Schmidt, J.C., 2014: Verantwortung für die wissenschaftlich-technische Zivilisation. Ein Plädoyer für eine Zugangs-Zukunfts-Ethik. In: Leiner, M.; Boomgaarden, J. (eds.): Kein Mensch, der der Verantwortung entgehen könnte. Ver-antwortungsethik in theologischer, philosophischer und religionswissenschaftlicher Perspektive. Freiburg, 167-193

Schmidt, J.C., 2015: Synthetic Biology as Late-Modern Technology. Inquiring into the Rhetoric and Reality of a New Technoscientific Wave. In: Giese, B.; Pade, C.; Wigger, H.; Gleich, A.v. (eds.): Synthetic Biology. Character and Im-pact. Heidelberg/New York, 1-30

Schmidt, J.C.; Liebert, W., 2014: Prospektive Technikfolgenabschätzung der Synthetischen Biologie. Über die Herausforderungen der nachmodernen Technik. In: Decker, M.; Bellucci, S.; Bröchler, S.; Nentwich, M.; Rey, L.; Sotoudeh, M. (eds.): Technikfolgenabschätzung im politischen System. Zwischen Konfliktbewältigung und Technologiegestal-tung. Berlin, 63-74

Schot, J.; Rip. A., 1996: The Past and Future of Constructive Technology Assessment. In: Technological Forecasting and Social Change 54, 251–268

Venter, C., 2010: The creation of 'Synthia'. http://www.thenakedscientists.com/HTML/content/interviews/interview/1332/. (download 20.6.13)

Zweck, A., 2002: Technologiefrüherkennung. Ein Instrument der Innovationsförderung. In: Wissenschaftsmanagement. Zeitschrift für Innovation, 2, 25-30

Footnotes:

1) Virtue ethical approaches might also be helpful in the context of navigating within the realm of technoscientific possibilities, but we do not discuss that aspect within the limited framework of this paper.

A Combined Approach of Prospective Risk Analysis, p. 341.

Coates, J. F. & Coates, V. T., 2003: Next stages in technology assessment - Topics and tools. In: Technological Forecasting and Social Change, 70, pp. 187–192

Fleischer, T., Decker, M. & Fiedeler, U., 2005: Assessing emerging technologies – Methodological challenges and the case of nanotechnologies. In: Technological Forecasting and Social Change 72(9), pp. 1112–1121

Grunwald, A., 2004: Vision Assessment as a new element of the FTA toolbox. In: EU-US Seminar New Technology Foresight, Forecasting & Assessment Methods, Seville (Spain)

Grunwald, A., 2009: Vision Assessment Supporting the Governance of Knowledge – The Case of Futuristic Nanotechnology. In: G. Bechmann, V. Gorokhov, & N. Stehr (eds.): The Social Integration of Science. Institutional and Epistemological Aspects of the Transformation of Knowledge in Modern Society. Gesellschaft - Technik - Umwelt, Vol. 12. Berlin: edition sigma, pp. 147–170

Guston, D. H. & Sarewitz, D., 2002: Real-time technology assessment. In: Technology in Society, 24, pp. 93–109

IPCC, 2007: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Edited by M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, & C. E. Hanson. Cambridge, UK: C. U. Press

IPCS, 2004: IPCS risk assessment terminology. WHO Document Production Services. Geneva

Karafyllis, N. C., 2009: Facts or Fiction? A Critique on Vision Assessment as a Tool for Technology Assessment. In: P. Sollie, & M. Düwell (eds.): Evaluating New Technologies. The International Library of Ethics, Law and Technology, Vol. 3. Springer Netherlands, pp. 93–117

Kuhlmann, S., 2013: Strategische und konstruktive Technikfolgenabschätzung. In: G. Simonis (ed.): Konzepte und Verfahren der Technikfolgenabschätzung Wiesbaden: Springer Fachmedien, pp. 129–143

Liebert, W. & Schmidt, J. C., 2010: Towards a prospective technology assessment: challenges and requirements for technology assessment in the age of technoscience. In: Poiesis & Praxis 7(1), pp. 99–116

Nordmann, A., 2010: A forensics of wishing: technology assessment in the age of technoscience. In: Poiesis & Praxis 7, pp. 5–15

Roy, J. R., Chakraborty, S. & Chakraborty, T. R., 2009: Estrogen-like endocrine disrupting chemicals affecting puberty in humans – a review. In: Medical Science Monitor 15(6), pp. 137–145

Simonis, G. (ed.), 2013: Konzepte und Verfahren der Technikfolgenabschätzung. Wiesbaden: Springer VS

Tran, T. A. & Daim, T., 2008: A taxonomic review of methods and tools applied in technology assessment. In: Technological Forecasting and Social Change 75(9), pp. 1396–1405

van den Ende, J., Mulder, K., Knot, M., Moors, E. & Vergragt, P., 1998: Traditional and modern Technology Assessment. Towards a toolkit. In: Technological Forecasting & Social Change, 58(1&2), pp. 5–21

von Gleich, A., Pade, C. & Wigger, H., 2013: Indizien und Indikatoren zur Umsetzung des Vorsorgeprinzips. In: Technikfolgenabschätzung– Theorie und Praxis 22(3), pp. 16–24

Footnotes:

1) TA methods are reviewed for example in van den Ende et al. (1998), Tran and Daim (2008) and Simonis (2013).

2) For a definition of exposure and hazard see IPCS (2004).

Problematizing New Technology. Making Sense of Synthetic Biology, p. 347.

Andrianantoandro, Ernesto, Basu, Subhayu, Karig, David, Weiss, Ron (2006): Synthetic biology: new engineering rules for an emerging discipline, Molecular Systems Biology 2, 0028.

Bogner, Alexander, Torgersen, Helge (2014): Different ways of problematising biotechnology − and what it means for technology governance. Public Understanding of Science online 24 June, DOI: 10.1177/0963662514539074

Callon, Michel (1986): Some elements of a sociology of translation: Domestication of the scallops and the fishermen of St Brieuc Bay. In: Law, John (ed.): Power, Action and Belief: A New Sociology of Knowledge? London: Routledge, pp. 196-223

Dahinden, Urs (2006): Framing. Eine integrative Theorie der Massenkommunikation. Konstanz: UVK

Delfanti, Alessandro (2013): Biohackers: The Politics of Open Science. London: Pluto Press

de Lorenzo, Victor (2010): Environmental biosafety in the age of synthetic biology: do we really need a radical new approach? Bioessays 32, 926–931

Dragojlovic, Nick, Einsiedel, Edna (2013): Framing Synthetic Biology: Evolutionary Distance, Conceptions of Nature, and the Unnaturalness Objection. Science Communication, 35(5): 547-571

Douglas, Conor M.W., Stemerding, Dirk (2013): Governing synthetic biology for global health trough responsible research and innovation. Systems and Synthetic Biology, 7(3): 139-150

ETC Group – Action Group on Erosion, Technology and Concentration (2007): Extreme Genetic Engineering. An Introduction to Synthetic Biology. www.etcgroup.org

Evans, John H. (2002): Playing God? Human Genetic Engineering and the Rationalization of Public Bioethical Debate. Chicago: University of Chicago Press

Foucault, Michel (1983): Discourse and Truth: The Problematization of Parrhesia. Berkeley, CA: University of California Press

Kurath, Monika, Gisler, Priska (2009). Informing, involving or engaging? Science communication, in the ages of atom-, bio- and nanotechnology. Public Understanding of Science, 18(5), 559-573

Vilanova, Cristina, Porcar, Manuel (2014): iGEM 2.0 – refoundations for engineering biology. Nature Biotechnology 32(5): 420-424

Nano Risk Governance, p. 353.

Gazsó, A.; Greßler, S.; Schiemer, F. (eds.), 2007: nano - Chancen und Risiken aktueller Technologien. Springer, Vienna

Gazsó, A.; Haslinger, J., 2014: Nano Risiko Governance. Der gesellschaftliche Umgang mit Nanotechnologien. Springer, Vienna

Institute of Technology Assessment (Austrian Academy of Sciences), 2006: Nanotechnologie-Begleitmaßnahmen: Stand und Implikationen für Österreich, Endbericht. Institut für Technikfolgen-Abschätzung im Auftrag des BMVIT, Vienna

Jakl, T., Hanslik, S., Mühlegger, S., Pogany, A., Pürgy, R., Susnik, M. and A. Zilberzsac (eds.), 2009: Austrian Nanotechnology Action Plan. Lebensministerium in cooperation with several ministries and authorities, Vienna

Pielke, R. A.; 2007: The Honest Broker. Making Sense of Science in Policy and Politics. Cambridge

Interdisciplinary Integration in Technology Assessment. A Report from Practise, p. 359.

Andersen, H.; Wagenknecht, S., 2013: Epistemic dependence in interdisciplinary groups. In: Synthese. An International Journal for Epistemology, Methodology and Philosophy of Science 190 (11), pp. 1881-1898

Decker, M.; Grunwald, A., 2001: Rational Technology Assessment as Interdisciplinary Research. In: Decker, M. (ed.): Interdisciplinarity in Technology Assessment. Implementation and its Chances and Limits. Berlin Heidelberg New York, pp. 33-60

Decker, M; Ladikas, M., 2007: Bridges between Science, Society and Policy. Technology Assessment – Methods and Impacts. Berlin Heidelberg New York

Kaiser, M., 2014: On Scientific Uncertainty and the Precautionary Principle. In: Gethmann, C.F.; Carrier, M.; Hanekamp, G.; Kaiser, M.; Kamp, G.; Lingner, S.; Quante, M.; Thiele, F.: Interdisciplinary Research and Trans-disciplinary Validity Claims. Cham Heidelberg New York, pp. 138-157

Kloepfer, M.; Griefahn, B.; Kaniowski, A.; Klepper, G.; Lingner, S.; Steinebach, G.; Weyer, H.; Wysk, P., (2006) Leben mit Lärm? Risikobeurteilung und Regulation des Umgebungslärms im Verkehrs-bereich. Berlin Heidelberg New York

Refsgaard, J.C.; van der Sluijs J.P.; Brown, J.; van der Keur, P., 2006: A framework for dealing with uncertainty due to model structure error. In: Advances in Water Resources 29, pp. 1586-1597

Thorstensen, E.; Forsberg, E.-M.; van Doren, D.; Heyen, N.; Reiss, T.; de Bakker, E.; Nielsen, R.Ø.; Ribeiro, B.; Smith, R.; Millar, K., 2014: An integrated framework for assessing societal impact of emerging science and technologies (EST-Frame deliverable 6.7). 7th EU Framework Programme. http://estframe.net/publications/content_1/text_721891ce-f43b-460e-80ed-339c02c7134d/1418825021825/estframe_deliverable_6_7_final.pdf (download 21.5.15)

Footnotes:

1) Extended interdisciplinarity stands here for the collaboration of distant faculties, like the technical or natural sciences with the humanities and/or social sciences.

2) The latter is enabled by appropriate presentation and publication strategies but, in a narrower sense no longer part of the academy's project workflow.

3) Compare to Decker/Ladikas (2007, p. 121) for an impact typology of TA arrangements.

Problem-Oriented Interdisciplinarity in Technology Assessment, p. 365.

Bechmann, G., Frederichs, G., 1996: Problemorientierte Forschung. Zwischen Politik und Wissenschaft. In: Bechmann, G. (ed.), 1996: Praxisfelder der Technikfolgenforschung. Frankfurt, 11-37

Becker, E., Jahn, T. (eds.), 2006: Soziale Ökologie. Grundzüge einer Wissenschaft von den gesellschaftlichen Naturverhältnis-se. Frankfurt

Böhme, G. et al. (eds.), 1983: Finalization in science. The social orientation of scientific pogress. Dordrecht, 276–311

Decker, M., 2010: Interdisziplinäre Wissensgenerierung in der TA – eine Prozessbeschreibung; In: Bogner, A., Kastenhofer, K., Torgersen, H. (eds.), 2010: Inter- und Transdisziplinarität im Wandel? Neue Perspektiven auf problemorientierte Forschung und Politikberatung. Baden-Baden, 45-165

Dörner, D., 1995: Die Logik des Mißlingens. Strategisches Denken in komplexen Situationen. Hamburg

Grunwald, A. (ed.), 1999: Rationale Technikfolgenbeurteilung. Konzepte und methodische Grundlagen. Berlin

Habermas, J., 1991: Erläuterungen zur Diskursethik, Frankfurt, 119-226 (Engl. transl.: In: Justification and Application. Remarks on Discourse Ethics. Cambridge, MA, 1993, 19-111)

Haken, H., 1980: Dynamics of Synergetic Systems. Berlin

Kuhn, T.S., 1996: Die Struktur wissenschaftlicher Revolution. Frankfurt

Liebert, W., Schmidt, J.C., 2010: Towards a prospective technology assessment. Challenges for technology assessment (TA) in the age of technoscience. In: Poiesis & Praxis 7(1-2), 99-116

Mittelstraß, J., 1998: Die Häuser des Wissens. Frankfurt

Pohl, C., Hirsch-Hadorn G., 2006: Gestaltungsprinzipien für die transdisziplinäre Forschung. München

Schmidt, J.C., 2003: Wundstelle der Wissenschaft. Wege durch den Dschungel der Interdisziplinarität. In: Scheidewege 33, 169-189

Schmidt, J.C., 2008: Tracing Interdisciplinarity of Converging Technologies at the Nanoscale: Ethical considerations about recent Nanotechnosciences. In: Technology Analysis and Strategic Management (TASM) 20(1), 45-64.

Schmidt, J.C., 2011: What is a Problem? On problem-oriented Interdisciplinarity. In: Poiesis & Praxis 7(4), 249-274

Thompson Klein, J., et al. (eds.), 2001: Transdisciplinarity: Joint problem solving among science, technology, and society. An effective way for managing complexity. Basel

Weinberg, A.M., 1972: Science and Trans-Science. In: Minerva, 10(2), 209-222

Weizsäcker, C.F. v., 1974: Die Einheit der Natur. München

Wolters, G., 2004: Problem. In: Enzyklopädie für Philosophie und Wissenschaftstheorie, Book 3, 347-348

Wright, G.H. v., 1991: Erklären und Verstehen. Meisenheim

Footnotes:

1) Also the OTA talks about "existing and emerging national problems".

2) In the 1970s, the underlying thesis of the internal-external dichotomy was broadly present in the finalization thesis advocated by van den Daele, Krohn and Böhme (Böhme et al. 1983): in certain phases of the evolution of sciences external goals drive internal development. Based on Kuhn's terminology, the external goals are driving the pre- and post-paradigmatic phases. Similar dichot-omies are present in concepts that emerged later, e.g., the theses of post-normal, post-academic, mode-II or techno-sciences.

Between Moralisation of Politics and Politicisation of Ethics, p. 371.

Barber, B., 1984: Strong Democracy. Participatory Politics for a New Age. Berkeley

Bogner, A., 2011: Die Ethisierung von Technikkonflikten. Studien zum Geltungswandel des Dissenses. Weilerswist

Bora, A., 2007: "Gesellschaftsberatung" oder Politik? – Ein Zwischenruf. In: Leggewie, C. (ed.): Von der Politik- zur Gesellschaftsberatung. Neue Wege öffentlicher Konsultation. Frankfurt a.M., 117–131

Briggle, A., 2009: The Kass Council and the Politicization of Ethics Advice. In: Social Studies of Science 39, 309–326

Bröchler, S., 2010: Technikfolgenabschätzung und Technology Governance. In: Aichholzer, G.; Bora, A.; Bröchler, S.; Decker, M.; Latzer, M. (eds.): Technology Governance. Der Beitrag der Technikfolgenabschätzung. Berlin, 63–74

Bröchler, S., 2013: Technik- und Innovationspolitik. In: Grunwald, A. (ed.): Handbuch Technikethik. Stuttgart, 379–384

Della Porta, D., 2013: Can Democracy Be Saved? Participation, Deliberation and Social Movements. Cambridge

Grunwald, A., 2013: Ethische Aufklärung statt Moralisierung. Zur reflexiven Befassung der Technikfolgenabschätzung mit normativen Fragen. In: Bogner, Alexander (ed.): Ethisierung der Technik – Technisierung der Ethik. Der Ethik-Boom im Lichte der Wissenschafts- und Technikforschung. Baden-Baden, 232–246

Nietzsche, F., 1980 [1889]: Götzen-Dämmerung oder Wie man mit dem Hammer philosophiert. Streifzüge eines Unzeitgemäßen. In: Colli, G.; Montinari, M. (eds.), Kritische Studienausgabe 6. Munich

Slovic, P., 2010: The Feeling of Risk. New Perspectives on Risk Perception. Abingdon and New York

Torgersen, H.; Bogner, A.; Kastenhofer, K., 2013: The Power of Framing in Technology Governance: The Case of Biotechnologies (ITA-manuscript 13-01). Vienna

Footnotes:

1) "Unsre [sic!] Institutionen taugen nichts mehr: darüber ist man einmütig. Aber das liegt nicht an ihnen, sondern an uns. Nietzsche" (1980, 39 [1889]); translation K.S.

2) The descriptive and normative dimensions have also been emphasised by Bröchler (2013; 2010,70) who distinguishes the following two usages of TG: "first, […] a normative concept […], promising better governance in the domain of technology policy. [There is,] second, an analytic usage […]"; my translation, K.S.

3) See for a well-versed discussion of this recent case the following blog entry by Gregory E. Kaebnick in the Hastings Center Bioethics Forum on "GM Mosquitoes: Risks and Emotions": http://www.thehastingscenter.org/Bioethicsforum/Post.aspx?id=http://scienceline.org/2014/03/when-science-bites-back/ 7295&blogid=140#. For current research in risk perception see Slovic (2010).

4) See http://www.bundesregierung.de/ContentArchiv/DE/Archiv17/_Anlagen/2011/05/2011-05-30-abschlussbericht-ethikkommission_en.pdf?__blob=publicationFile&v=2 (2015/06/30)

5) Süddeutsche Zeitung, 4 April 2011; http://www.sueddeutsche.de/wissen/atomkatastrophe-in-fukushima-ein-biblisches-gebot-1.1080890 (2015/06/30)

6) Bora (2007) is sceptical about Gesellschaftsberatung (societal counselling). In my view, consulting and counselling the public (the public in both a subject and an object sense) is part and parcel of TG in the political sphere and is compatible with both deliberative and participatory models of democracy such as the ideal type in Barber's Strong Democracy (1984).

7) For a normative conception of democracy combining the two, see Della Porta (2013, 64–67).

TTIP and How to Cooperate between Technological Assessment and Emotion, p. 377.

Rudloff, B., 2014, Food Standards in Trade Agreements, Differing Regulatory traditions in the EU and the USA and Tips for TTIP, SWP Comments 49, 2014

Wieck, C.; Rudloff, B., 2014, Prospects of regulatory cooperation on agri-food standards between EU and US: A discussion of potential cost, benefits and consequences of different cooperation strategies. Selected Paper presented at IATRC Annual Meeting "Food and Resources: Conflict and Trade", December 7-9, San Diego

Codex Alimentarius Commission, 2013, Guidelines on the Application of Risk Assessment for Feed, CAC/GL 80-2013. Rome

Codex Alimentarius Commission, 2007, Risk Analysis. In Codex Alimnetarius (ed.): Procedural Manual. Rome, p. 111- 201

The Importance of Strong Science Journalism in Technology Assessment, p. 383.

Using Short Films for Public Engagement with Synthetic Biology, p. 389.

Bogner, A.; Torgersen, H.,2014: Different ways of problematising biotechnology – and what it means for technology governance. In: Public Understanding of Science published online 24 June 2014 DOI: 10.1177/0963662514539074

Van Lente, H.; Coenen, C.; Fleischer,T; Konrad,K.; Krabbenborg, L.; Milburn, C.; Thoreau, F.; Zülsdorf, T.B. (eds), 2012: Little by Little - Expansions of Nanoscience and Emerging Technologies, IOS Press / AKA, Heidelberg

Long, S.; Ostman, R., 2012: Using Theatre and Film to Engage the Public in Nanotechnology. In: Van Lente, H. et al (eds). Little by Little - Expansions of Nanoscience and Emerging Technologies, IOS Press / AKA, Heidelberg

Miller, C. A.; Bennett, I., 2008: Thinking longer term about technology: is there value in science-fiction inspired approaches to constructing futures? In: Science and Public Policy 35/8 (2008), pp. 597-606

SCENIHR 2014. Final Opinion on Synthetic Biology: Definition. Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) http://ec.europa.eu/health/scientific_committees/emerging/docs/scenihr_o_044.pdf (download 12.06.2015)

Schmidt, M.; Ganguli-Mitra, A.; Torgersen H.; Kelle A.; Deplazes A.; Biller-Andorno N., 2009: A Priority Paper for the Societal and Ethical Aspects of Synthetic Biology. In: Systems and Synthetic Biology .3(1-4) (2009), pp. 3-7

Schmidt, M.; Meyer, A.; Cserer, A., 2015: The Bio:Fiction film festival: Sensing how a debate about synthetic biology might evolve. In: Public Understanding of Science 24/5 (2015), pp. 619-635

Schwarz, J. O., 2015: The 'Narrative Turn' in developing foresight: Assessing how cultural products can assist organisations in detecting trends. In: Technological Forecasting and Social Change 90 (2015), pp. 510-513

Torgersen, H.; Schmidt, M., 2013: Frames and comparators: How might a debate on synthetic biology evolve? In: Futures 48 (2013), pp. 44-54

Footnotes:

1) See: www.bio-fiction.com/2014
2) See: http://bio-fiction.com/en
3) For more information about all 60 films, see: http://bio-fiction.com/2014/#call-for-submission
4) See: www.synenergene.eu

Acknowledgement:

The session, as well as the BIO·FICTION Film Festival, was organized as a part of the EU-funded SYNENERGENE project which explores benefits and risks of synthetic biology, as well as its societal shaping in a responsible, collaborative and participative manner.

Visions of Technology Assessment. Approaches Used by DG JRC, p. 397.

BMBF (German Federal Ministry of Education and Research), 2012: Project of the Future: Industry 4.0, Berlin, http://www.bmbf.de/en/19955.php?hilite=Industry+4.0 (download 18.05.15)

Bock, A.-K., Maragkoudakis, P., Wollgast, J. Caldeira, S., Czimbalmos, A., Rzychon, M., Atzel, B. Ulberth, F., 2014: Tomorrow's healthy society – Research priorities for food and diets, JRC foresight study, https://ec.europa.eu/jrc/sites/default/files/jrc-study-tomorrow-healthly-society.pdf (download 18.05.15)

European Commission, 2010: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, An Integrated Industrial Policy for the Globalisation Era – Putting Competitiveness and Sustainability at Centre Stage, COM(2010) 614 final

European Commission, 2012: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A Stronger European Industry for Growth and Economic Recovery – Industrial policy communication update, COM(2012) 582 final

European Commission, 2014a: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, For a European industrial renaissance, COM(2014) 14 final

European Commission, 2014b: Staff working Document from the Commission, Advancing Manufacturing – Advancing Europe – Report of the Task Force on Advanced Manufacturing for Clean Production, 19 March 2014 SWD (2014)120 final

Joint Research Centre, 2015: European Commission, Joint Research Centre Mission Statement, https://ec.europa.eu/jrc/en/about (download 15.07.2015)

Juncker, J.-C., 2014: My Agenda for Jobs, Growth, Fairness and Democratic Change, Political Guidelines for the next European Commission, Opening Statement in the European Parliament Plenary Session President-elect of the European Commission, Strasbourg, 22 October 2014, Candidate for President of the European Commission Strasbourg, 15 July 2014, http://ec.europa.eu/priorities/docs/pg_en.pdf (download 18.05.15)

Scapolo, F., Churchill, P., Viaud, V., Antal, M. Córdova, H., De Smedt, P., 2014: How will standards facilitate new production systems in the context of EU innovation and competitiveness in 2025? JRC foresight study, http://publications.jrc.ec.europa.eu/repository/bitstream/JRC93699/jrc_27ap15_2rep_web.pdf (download 18.05.15)

Footnotes:

1) http://publications.jrc.ec.europa.eu/repository/bitstream/JRC94867/lbna27252enn.pdf

Afterword: Technology Assessment As Political Myth, p. 403.

Footnotes:

1) This paper summarizes a talk given at PACITA: The Second European Technology Assessment Conference, February 2015, in Berlin, Germany. The talk and paper draw upon previously published work; the section on "basic research" draws on Pielke (2013) and also work in progress, while the section on the green revolution draws on an ongoing collaboration with Björn Ola-Linnér.

2) Gunnell, John. 1968. "Social Science and Political Reality: The Problem of Explanation." Social Research 35: 159-201.

3) http://www.jstor.org/stable/448911?seq=1#page_scan_tab_contents

4) http://www.economist.com/blogs/democracyinamerica/2011/07/bin-laden-vaccine

5) http://online.wsj.com/articles/SB10001424127887323300004578555453881252798

6) http://www.washingtonpost.com/opinions/its-time-to-get-serious-about-science/2012/09/09/5b5c1472-f129-11e1-892d-bc92fee603a7_story.html

7) https://www.google.com/intl/en/about/

8) http://www.csiic.ca/PDF/TheMakingOfScience.pdf

9) http://www.google.com/about/company/history/

10) http://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=100660

11) http://archive.org/details/scienceendlessfr00unit

12) www.google.com, search terms "green revolution in Mexico" and "green revolution in India", 2013.11.19.

13) Patel 1982.

14) Conway 1997

15) Rosset 2000

16) Otero and Pechlaner 2008

17) http://www.economist.com/news/briefing/21601815-another-green-revolution-stirring-worlds-paddy-fields-bigger-rice-bowl

ANNEX

Alphabetical Lists of:

Contributors

A

Aichholzer, Georg, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, p. 165

Albrecht, Steffen, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 151

Albrecht, Stephan, Technology Assessment, University of Hamburg, Germany, p. 49

Almeida, Mara, Universidade Nova de Lisboa, Portugal, p. 23

Anspach, Renee, University of Michigan, United States of America, p. 199

B

Bachlechner, Daniel, Fraunhofer ISI, Germany, p. 243

Bashevoy, Maxim, IT Innovation Centre, United Kingdom, p. 253

Bavorová, Miroslava, Martin-Luther University Halle-Wittenberg, Germany, p. 301

Bechtold, Ulrike, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, pp. 101, 139, 223

Bescherer, Peter, University of Tuebingen, Germany, p. 271

Bitsch, Lise, Danish Board of Technology Foundation, Denmark, p. 81

Boavida, Nuno, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany; Universidade Nova de Lisboa, Portugal, p. 33

Bogner, Alexander, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, pp. 127, 347

Böhle, Knud, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 317

Bongert, Elisabeth, Technology Assessment, University of Hamburg, Germany, p. 49

Bontoux, Laurent, European Commission DG Joint Research Centre, Belgium, p. 397

Böschen, Stefan, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 33

Bossen, Gotje, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 185

Boucher, Philip, European Commission DG Joint Research Centre, Belgium, p. 397

Bryndum, Nina, Danish Board of Technology Foundation, Denmark, p. 57

Burchardt, Ulla, Social Democratic Party, Germany, p. 57

Bütschi, Danielle, TA-SWISS, Switzerland, p. 23

C

Capari, Leo, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, p. 139

Čas, Johann, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, p. 265

Coenen, Christopher, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 151

D

Decker, Michael, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 249

Dewald, Ulrich, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 53

Döring, Ole, Berlin, Germany, p. 41

Droste-Franke, Bert, EA European Academy of Technology and Innovation Assessment GmbH, Germany, p. 173

F

Fernandez, Miriam, Open University, United Kingdom, p. 253

Friedewald, Michael, Fraunhofer Institute for Systems and Innovation Research ISI, Germany, p. 259

Friedman, Charles, University of Michigan, United States of America, p. 199

Fuchs, Daniela, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, p. 353

Fuchs, Gerhard, University of Stuttgart, Germany, p. 179

G

Gazsó, André, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, p. 353

Giese, Bernd, University of Bremen, Germany, pp. 327, 341

Gudowsky, Niklas, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, p. 139

H

Hahn, Julia, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 11

Hampel, Jürgen, University of Stuttgart, Germany, p. 133

Harriss, Lydia, Parliamentary Office of Science and Technology, United Kingdom, p. 229

Hebáková, Lenka, Technology Centre of the Academy of Sciences of the Czech Republic, p. 11

Heidingsfelder, Marie, Fraunhofer Center for Responsible Research and Innovation, Germany, p. 145

Hennen, Leonhard, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 11

Hildt, Elisabeth, Illinois Institute of Technology, United States of America, p. 157

Hocke, Peter, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 121

Hofmaier, Christian, University of Stuttgart, Germany, p. 157

I

Ibrahim, Osama, eGovlab, Sweden, p. 253

J

Jacobson, Peter, University of Michigan, United States of America, p. 199

Jahnel, Jutta, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 75

Jelínek, Ladislav, Martin-Luther University Halle-Wittenberg, Germany, p. 301

Jensen, Sven, University of Bremen, Germany, p. 341

Joly, Pierre-Benoit, French National Institute for Agricultural Research, Paris, p. 87

Joshi, Somya, eGovlab, Sweden, p. 253

K

Kahlisch, Carolin, Institute for Futures Studies and Technology Assessment, Germany, p. 107

Kaiser, Simone, Fraunhofer Center for Responsible Research and Innovation, Germany, p. 145

Kamphof, Ike, Maastricht University, Netherlands, p. 213

Kardia, Sharon, University of Michigan, United States of America, p. 199

Kenny, Caroline, Parliamentary Office of Science Technology, United Kingdom, p. 19

Kerbe, Wolfgang, Biofaction KG, Austria, p. 389

Khodzhaeva, Antonina, independent researcher, Germany, p. 389

Kim, Yeonwha, Korean Institute of Science and Technology Evaluation and Planning, South Korea, p. 295

Kimpel, Kora, Berlin University of the Arts, Germany, p. 145

Koenigstein, Stefan, University of Bremen, Germany, p. 341

König, Harald, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 151

Krings, Bettina-Johanna, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 217

Krom, André, Rathenau Instituut, Netherlands, p. 193

Kronberger, Nicole, Johannes Kepler University Linz, Austria, p. 133

Kuppler, Sophie, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 121

L

Larsson, Aron, eGovlab, Sweden, p. 253

Lee, Seung Ryong, Korean Institute of Science and Technology Evaluation and Planning, South Korea, p. 295

Leimbach, Timo, Aarhus University, Denmark, p. 243

Liebert, Wolfgang, Darmstadt University of Applied Sciences, Germany, pp. 327, 331

Lindner, Ralf, Fraunhofer ISI, Germany, p. 57

Lingner, Stephan, EA European Academy of Technology and Innovation Assessment, Germany, p. 359

M

Maia, Maria João, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 207

Marschalek, Ilse, Centre for Social Innovation, Austria, p. 93

Michalek, Tomáš, Technology Centre of the Academy of Sciences of the Czech Republic, pp. 11, 37

Moniz, António Brandão, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, pp. 249, 287, 311

N

Neukirch, Mario, University of Stuttgart, Germany, p. 185

Nielsen, Morten Velsing, Danish Board of Technology Foundation, Denmark, pp. 57, 81

Nielsen, Rasmus Øjvind, Danish Board of Technology Foundation, Denmark, p. 81

Nierling, Linda, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 217

O

Oertel, Britta, Institute for Futures Studies and Technology Assessment, Germany, p. 107

Opielka, Michael, Institute for Futures Studies and Technology Assessment, Germany, p. 107

P

Pellé, Sophie, Sciences Po, France, p. 63

Pielke, Roger, Jr., University of Colorado, United States of America, p. 403

Platt, Jodyn, University of Michigan, United States of America, p. 199

Prabhu, Robindra, Norwegian Board of Technology, Norway p. 237

R

Revuelta, Gema, Universitat Pompeu Fabra, Spain, p. 157

Rudloff, Bettina, German Institute for International and Security Affairs, Germany, p. 377

S

Saladié, Núria, Universitat Pompeu Fabra, Spain, p. 157

Scapolo, Fabiana, European Commission DG Joint Research Centre, Belgium, p. 397

Scherz, Constanze, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 11

Schmidt, Jan C., Darmstadt University of Applied Sciences, Germany, pp. 327, 331, 365

Schmidt, Markus, Biofaction KG, Austria, p. 389

Schofield, Monica, TuTech Innovation GmbH, Germany, p. 57

Schraudner, Martina, Fraunhofer Center for Responsible Research and Innovation, Germany, p. 145

Schütz, Ronja, Johannes Gutenberg University of Mainz, Germany, p. 157

Seitz, Stefanie B., Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, pp. 11, 115

Sotoudeh, Mahshid, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, p. 139

Spaapen, Jack, Royal Netherlands Academy of Arts and Sciences, Netherlands, p. 27

Stahl, Bernd, De Montfort University, United Kingdom, p. 69

Stemerding, Dirk, Rathenau Instituut, Netherlands, p. 193

Stilgoe, Jack, University College London, England, p. 57

Stoppenbrink, Katja, University of Muenster, Germany, p. 371

Strauß, Stefan, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, p. 233

Swierstra, Tsjalling, Maastricht University, Netherlands, p. 87

T

Taylor, Steve, IT Innovation Centre, United Kingdom, p. 253

Torgersen, Helge, Institute of Technology Assessment, Austrian Academy of Sciences, Austria, p. 347

Tyler, Chris, Parliamentary Office of Science Technology, United Kingdom, p. 19

V

Van Kasteren, Joost, frelance journalist, Netherlands, p. 383

Van Lente, Harro, Maastricht University, Netherlands, p. 87

Van Lieshout, Marc, Netherlands Organisation for Applied Science, Netherlands, p. 259

Van Oudheusden, Michiel, University of Liège, Belgium, p. 287

Von Gleich, Arnim, University of Bremen, Germany, p. 341

W

Wandhöfer, Timo, Leibniz-Institute for the Social Sciences, Germany, p. 253

Weber, Arnd, Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, Germany, p. 53

Wilfing, Harald, University of Vienna, Austria, p. 101

Y

Yoshizawa, Go, Osaka University, Japan, p. 287

Z

Zacher, Lech W., Kozminski University, Poland, p. 279

120

Acronyms

AAL – Autonomous and Ambient Assisted Living
AmI – Ambient Intelligence
ANPR – Automatic Number Plate Recognition
AT – Assistive Technology
CAC – Codex Alimentarius Commission
CCTV – Closed Circuit Television
CERN – Conseil Européen pour la Recherche Nucléaire
COCOM – Coordinating Committee for Multilateral Export Controls
CSO – Civil Society Organisation
CSR – Corporate Social Responsibility
DG – Directorate-General of the European Commission
DIY – Do It Yourself
DNA – Deoxyribonucleic Acid
EC – European Commission
EEC – Eastern European Countries
EHS – Environmental, Health and Safety
ELSA – Ethical, Legal and Societal Aspects
ELSI – Ethical, Legal and Social Implications
EPTA – European Parliamentary Technology Assessment Network
ESRC – Economic and Social Research Council
EST – Emerging Science and Technology
EU – European Union
FA – Frame Adoption
FAO – Food and Agriculture Organization of the United Nations
FMEA – Failure Mode and Effects Analysis
FP – Future Panel
GAO – U.S. Government Accountability Office
GDP – Gross Domestic Product
GMO – Genetically Modified Organisms
HVDC – High Voltage Direct Current
IA – Impact Assessment
ICT – Information and Communication Technology
ID – Interdisciplinarity
iGEM – International Genetically Engineered Machine Competition
INGOs – International Non-Governmental Organizations
IRGC – International Risk Governance Council
ISP – Internet Service Provider
JRC – Joint Research Centre
KBE – Knowledge-Based Economy
KETs – Key Enabling Technologies
LDCs – Less Developed Countries

MADM – Multi-Attribute Decision-Making
MCDA – Multi-Criteria Decision Analysis
MMLAP – Mobilisation and Mutual Learning Action Plan
MR – Mutual Recognition
NEST – New and Emerging Science and Technologies
NGOs – Non-Governmental Organizations
NGS – Next Generation Sequencing
NI – Nano Initiative
NIMBY – Not in My Backyard
NIP – Nano Information Platform
NRC – National Research Council
NSA – National Security Agency
NSTC – National Science and Technology Council
OECD – Organization for Economic Cooperation and Development
OR – Operations Research
OTA – Office of Technology Assessment
PACITA – Parliaments and Civil Society in Technology Assessment
PHG – Public Health Genomics
POST – Parliamentary Office of Science and Technology
PRISMS – Privacy and Security Mirrors
ProTA – Prospective Technology Assessment
pTA – Participatory Technology Assessment
PYOs – Political Youth Organizations
R&D – Research and Development
RFID – Radio-Frequency Identification
RRI – Responsible Research and Innovation
RTD – Research and Technology Development
S&T – Science and Technology
SB – Synthetic Biology
SMEs – Small and Medium Enterprises
SPS – Agreement on Sanitary and Phytosanitary Measures
STI – Science, Technology, and Innovation
STOA – Science and Technology Options Assessment
STS – Science and Technology Studies
TA – Technology Assessment
TAB – Technology Assessment Office of the German Bundestag
TFEU – Treaty of the Functioning of the European Union
TG – Technology Governance
TNCs – Transnational Corporations
TranSTEP – TranS-domain Technology Evaluation Process
TSO – Transmission Grid Operators
UN – United Nations
VA – Value Ageing
VET – Veterinary Agreement
WEP – Wind Energy Plant
WHO – World Health Organization
WTO – World Trade Organization

Figures

Tables

Index

ISBN 978-80-7333-121-4

9 788073 331214

The European Technology Assessment Conference in Berlin was organized by the Institute for Technology Assessment and Systems Analysis – Karlsruhe Institute of Technology in cooperation with the Technology Centre ASCR as a part of the EU-financed FP7 project, Parliaments and Civil Society in Technology Assessment (PACITA).

PACITA

TECHNOLOGY CENTRE ASCR

ITAS Institute for Technology Assessment and Systems Analysis