EPINET conceptual analysis: **Integrated assessments in technoepistemic networks**

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Summary

This text aims to contribute to the articulation of some overarching tendencies at the levels of European governance of technosciences as studied by the Epinet project. It specifically targets the broader conditions under which different forms of assessments may integrate (or not) into broad networks shaping to address innovation for societal challenges in the European Union. It develops a concept of technoepistemic networks to account for main developments on the intersections of science and society across Europe. It argues that the technoepistemic networks increasingly conflate political and technoscientific aims, thereby undermining traditional sources of legitimacy, including those existing at national levels. This puts assessment practices (including recent efforts towards Responsible Research and Innovation), but also law and science, under increasing pressure. There is a need to think about and plan for the broader conditions under which innovation for societal challenges take place, including safeguarding the role of science, law and assessment practices.

Introduction: conceptualising technoscience, governance and integrated assessments

The purpose of this brief is to serve as a repository for thinking about the integration of technology assessments (TA) in the main technoscientific fields of innovation and in innovation policy development. In accordance with the conceptual basis of EPINET (Rommetveit et al. 2012), this brief conceives of "assessments" not as an isolated activity but rather as something that is carried out in conjunction and interaction across scientific disciplines and other sectors such as law, industry, science, and politics. This is in line with recent thinking about Responsible Research and Innovation, insofar as our work aims to capture some of the broader conditions under which different actors can come together (or not). In recent thinking about RRI such cross-cutting activities are explicitly encouraged and carried out in reference to *the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products. In other words, the aim is to allow a proper embedding of scientific and technological advances in our society* (von Schomberg 2012). Similarly, Stilgoe and Owen (2012) refer to greater levels of reflexivity and awareness, as more and more actors and networks are brought together in and across innovation domains and disciplines.

The analysis we have conducted here is connected to that of WP2 which has been looking empirically at assessment networks and interdisciplinarity. In coming together, these research lines demonstrate that cross-disciplinarity in use of concepts and in cross-disciplinarity in practice, is seen as desirable and that it ought to be actively pursued. However, high expectations of cross-sectoral activity and of what interdisciplinarity will achieve, are somewhat at odds with any actual events of putting that to practice. Integration of method and approach, and interdisciplinarity more generally are riddled with complications and not easily turned into practical achievements. We suggests that the problems are further exacerbated with increasing political pressures on the practices already involved in one or another assessment method, and the expectations that they work together to integrate their evaluations of new-emerging innovations.

Technoscience addressing societal challenges, breaking down silos

EPINET has been analysing four fields of technoscientific innovation, most of which are in relatively early stages of implementation and marked by only partial and incomplete (to varying degrees) understandings of their societal, ethical and legal implications. These partial and incomplete understandings are generally paralleled with inadequately mediating (integrating, cross-cutting) policy actions, institutions and networks. The innovation domains are: **wearable sensors and behavioural change** (WP3), - **autonomous robots in care and companionships** (WP4), - **the growing of in vitro meat (or not**) (WP5), and **smart grids for transition towards sustainable energies** (WP6).

In terms of European policies these developments can be traced to (at least) two different, though related, sources of influence. First, there is a persistent drive towards innovation which by now has a long tradition in Europe but became much more

pronounced following the Lisbon agenda. The drive towards innovation was further accelerated by the economic downturn of 2008, although, conditions for funding have shifted. Higher contributions of national budgets and industry will now have to make up for lesser EC funds available to implement the Horizon 2020 policy agenda and funding programme. But, the general agenda still follows broadly the 2006 Aho report recommendation that: *Europe and its citizens should realise that their way of life is under threat but also that the path to prosperity through research and innovation is open if large scale action is taken now by their leaders before it is too late*. The second source of influence for these policies is of a more recent origin, and perhaps not yet well understood nor well articulated. It is the notion laid down in the 2009 Lund Declaration that research and innovation should target directly key societal challenges. This is implemented already in 'priority 3' of the Horizon 2020 policy agenda, titled 'Societal Challenges' which then have been integrated into the very structure of H2020 programmes and calls.

As a consequence of these demands now placed on research and innovation agendas we observe strong tendencies towards 'cross-sectoral actions', as when the recent commissioner for Research, science and innovation, Carlos Moedas (paraphrasing Jean-Claude Juncker) in his inauguration speech stated how 'working in silos is not an option'. During his speech, Moedas kept returning specifically to the topic of policy silos and the need for cross-cutting actions. Although Moedas is navigating the Brussels bureaucratic machinery (which is one type of cross-cutting, ie. between DGs, between expert networks, between nation states) the metaphor of 'silos' and of breaking them down, is indicative of a problematic which has drawn our attention to what we term 'technoepistemic networks'. These are networks of actors (know-how and resources) working to innovate and integrate across sectoral and disciplinary domains throughout Europe and beyond. It is also characteristic of developments within the TA and RRI communities towards a pooling of resources, working in larger interdisciplinary teams, and generally 'integrating' with technology developers, researchers and (to some extent) policy makers. Hence, as we now explain, these developments lead to a blurring of boundaries between what is traditionally conceived as the relatively separate domains of research and innovation, policy making and technology assessment.

Hybrid governance through technoepistemic networks

In three of the above-mentioned cases we identify explicit policy agendas that connect technoscientifc innovation with specific societal purposes, ie. wearable sensors, autonomous robotics and smart grids. In the vocabulary used by Epinet, each area is operatively an epistemic network[1] (Rommetveit et al. 2012, Haas 1992, Nordmann

1 The concept borrows from the following sources of academic analysis: first, Peter Haas (1992) article (on epistemic communities) is a modern classic in the field of *international relations*. However, it is mainly targeted at a specific kind of knowledge workers, ie. the classic realist notion of science providing neutral representations, performing the task of ”speaking truth to power”. According to *philosophers of technoscience* (Nordmann 2006), the technosciences (as studied by Epinet) stand out not because of the ways in which they provide neutral and disinterested representations, but rather due to their focus on doing, making and engineering. Within technoscientific networks, the provision of neutral representations are

2006). Although primarily dedicated to the making of new things and process through innovation, these networks are also indicative of *hybridity in forms of governance*. Some characteristics of these networks include:

- they actively work to organise innovation and market-making at a European level, targeted towards European policy goals;
- they make new relations across national boundaries by joining forces with relevant forms of expertise and experience from different countries.
- they forge new relations across sectoral and disciplinary domains, although commonly building on existing forms of expertise, technologies and infrastructures (such as the European energy grids).
- The occasion for new actors and nodes to be connected to the networks are ofte-times heavily ICT-driven ones, cutting across the physical/digital divide, such as smart meters, wearable sensors, or improved robot sensors and actuators.

These developments take place simultaneously through the EU institutions and in shaping national networks. EU institutions do not by themselves possess the necessary forms of expertise, and so are dependent on external help. In mobilizing expertise from the different member states they simultaneously also integrate the members states into the Brussels 'network of networks' (see Barry 2001). On their side, expert networks from within the member states can achieve competitive advantages and increased standing within their home countries by uniting with similar networks across state lines: with other member states and with Brussels/the EU. Hence, national authority is used for networking abroad; international relations and connections in Brussels are used for enhancing authority and policy relevance at home.

A good example of such a network is the newly formed Public-Private Partnership (PPP) of robotics. It mainly consists of industry, academic research and policy makers, but it increasingly also involves lawyers, ethicists, social scientists and public relations workers charged with the task of paving the way for a new generation of robots. One could say that very little unites many of these expert networks [2], apart from their dedication to realising the vision of autonomous robots for specific societal purposes. In the case studied by Epinet this is a a prominent role within the EU agenda addressing

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placed at the service of technological interventions into natural and social systems. Also relevant to the concept is the notion of the *Actor-Network* (Latour 2005) with its emphasis on material entanglements and the drive towards increasing hybridisation. Equally relevant is the notion of *socio-technical imaginaries* (Jasanoff and Kim 2009), corresponding to the normative and technoscientific ideas, images and meanings that serve to guide and coordinate action across different parts of the network.

2 Hence, a recent euRobotics Roadmap (2014) starts out by explaining how ”Each person will read this document, and the Strategic Research Agenda, with a different perspective”. Pluralism is recognised, but also contained, within the limits of the strategic agenda. http://www.eu-robotics.net/cms/upload/PDF/Multi-Annual_Roadmap_2020_Call_1_Initial_Release.pdf

demographic problems by developing autonomous robots for care and companionship.

The main distinguishing trait of a technoepistemic network is exactly this dedication, across its different constituent networks, to realise the technoscientific innovation in close conjunction with one or more specified societal challenge. Hence, whereas great diversity exists between the actors within the broader network (such as law, politics, science and industry), the *sine qua non* of the technoepistemic network is the commitment to the realisation and making of a specific technoscientific application coupled with one or more clearly identified societal challenges.

As a counter-example we mention the fourth case study of Epinet, In-Vitro Meat (IVM), a group of networks trying to establish itself around the making of IVM, legitimising this innovation domain in relation to differing rationales, societal and environmental goals: from countering climate change to improving population and individual health, to alleviating the suffering of animals, to the need to feed the world. In this case we do not identify a set of stabilised innovation and policy goals, and the only common denominator across the networks' constituent parts remains the dedication to realise IVM as a biotechnology. Therefore, the IVM network does not qualify as a genuine technoepistemic network, but rather as a set of more loosely connected actors trying to establish themselves as such (and as of yet not succeeding). For instance, there is no technology platform to stabilise their relation with EU policy makers, and they have no high-level representatives within the Commission or elsewhere to bring their case forward; they struggle with recognition among their scientific peers.

The technoepistemic networks hold out the promise of re-making societal relations, mainly centred around wide-spread and pervasive technoscientific infrastructures, many of which are ICT-driven. They come along with specific policies and institutional dynamics, seen as necessary for their realisation. Some of these dynamics have been outlined above. It is important to understand them, and the institutions and networks developing around them, in order to appreciate the prospects (limitations and possibilities) for actual integration of technology assessments and the requirements of Responsible Research and Innovation, into the large-scale programmes, the agenda setting and the innovation networks of the EU.

Assessments: integration into technoepistemic networks

Historically oriented work conducted for WP1 is a treatise on how 'integrated assessments' of the impacts of science and technology on social and environmental relations have changed over-time. Classical TA was predicated on notions of a 'rational scientific process', and targeted towards parliamentarians. Later efforts have also included efforts towards integrating with technoscientific innovations themselves, e.g., constructive technology assessments, ELSA research and so-called integrated projects. Recent and ongoing efforts towards Responsible Research and Innovation (RRI) continue such developments, but are also actively transforming and expanding them (further strengthening the European level, also targeting policy agendas, towards possible

futures, cf. von Schomberg 2012).

Many of these characteristics follow from, and indeed mirror, the developments within the technoepistemic networks themselves: First, the technoscientific networks make assessments about societal needs, as when it is expected that behavioural change can be induced by introducing wearable sensors and mobile phone applications, or when autonomous robots are called upon to address ageing and negative demographics. This is a reflection of developments in which increasingly societal, political and environmental challenges (and dedications towards *change*) are delegated to technoscientific research and innovation (Rommetveit and Wynne, forthcoming). This tendency actively promotes and to some extent achieves a blurring of boundaries between the domains of research and innovation, law, politics, industry, democratic institutions, and everyday lives. Similarly, the boundaries blur between innovators, policy makers and assessors. Societal, ethical and legal assessments are themselves becoming 'integrated' into the technoepistemic networks, to the extent that they, and their methods, may become hard to distinguish from the work of technoscientific innovators. For instance, we observe the influx of 'ethical entrepreneurs' (Rip 2009). Assessors operate as members of larger teams, 'integrated ELSA', and large-scale interdisciplinary RRI projects: they do not stand outside the network whose practice and products they assess (What Arie Rip, 2006, terms 'governance in complexity' rather than 'governance of complexity').

Examples of such increasing integration and blurring of boundaries are clearly indicated in tasks such as: the hard-coding of ethical and legal principles (dignity, privacy, data protection, but also morals) into technological infrastructures, and so-called integrated projects, where RRI or ELSA actors operate as members of the larger networks. Frequently and increasingly such efforts go hand-in-hand with design-oriented approaches and “value-sensitive design”. And, in the regulatory area we see increased emphasis on scientific risk management and assessments, again performing a blurring of boundaries, or 'breaking down of silos', between technoscientific innovators, policy makers and assessors.

Finally, on the boundaries of such technoepistemic networks we observe more loosely tied networks of innovators, sometimes making up distinct technoscientific publics. Examples here include DIY biology, maker and hacker movements, consumer organisations, networks dedicated to the promotion of open culture and to the digital commons. In WP3 we have observed how citizens and users are experimenting with taking management of health and lifestyle data into their own hands, experimenting with wearable sensors, hand-held devices, apps and social media. To varying degrees such alternative innovation networks may integrate with and influence the actions of technology developers and policy makers (Gunnarsdóttir et al. 2014, Gunnarsdóttir et al. submitted); at other times they play against them, opposing the goals and/or means by which the predominant forces of the technoepistemic networks operate, and organising around alternative visions (see for instance Levidow et al. 2013).

Changes of scope, scale and social relations

One practical result of the activities of technoepistemic networks is the occurrence of more and more issues, challenges and policies at specifically European levels. Hence, they perform a change of scale and ambition, as well as a step change towards (generally) more competition-driven and market-oriented behaviours. While such developments are long in the coming, their impacts are becoming, as of recently, more pronounced and visible. In the field of technology assessment and governance, we observe how national actors have been dismantled (Denmark, Flandern [3]), with the previous leader of the Danish Board of technology talking about a tendency towards the "competition state" [4]. This is one in which policy-makers and technology assessors increasingly compete for attention and position through the EU institutions, upon which they become increasingly dependent. To paraphrase Andrew Barry, the network of the networks is becoming stronger.

Similarly, quite recent studies of governance of science and technology in Europe (Hagendijk and Irwin 2006) remained focused on the different national regulatory cultures (cf. Jasanoff 2004). Today, however, one may just as well analyse main differences in governance of science and technology in relation to the different waves of technologies, such as bio-, nano-, and various ICT-driven game-changers (Internet of Things, Big Data, next generation robotics, and so on.). Each comes along with new modes of governance, in many cases cutting across national cultures (a similar argument is made for scientific advisory bodies by Bijker et al. 2009, 43), working in more horizontal ways across state lines. We observe how the technoepistenmic networks perform a kind of *infra-governmentality* as they increasingly work horizontally to induce and produce new modes of governance. The challenge for member states, individual and professional communities alike, is that of latching onto developments, by making the agendas their own, and by actively working to promote and fulfil the promises of the innovation agendas[5].

To summarise: in observing and commenting upon recent developments in innovation, policy and governance, it is not our intention to idealise or display them as straightforward and streamlined tendencies. Indeed, competition-driven behaviours coupled with strong beliefs in technologies and markets as the main drivers of integration may backfire as the on-going negotiations over the Eurozone clearly demonstrate. We frequently observe a disconnect between predominant visions and the realities on the ground, for example, implementing visions and agendas in practice

[3] With most of the TA activities dislocated to other places. See http://easst.net/easst-review/easst-review-volume-311-march-2012/a-pioneer-in-trouble-danish-board-of-technology-are-facing-problems/, and http://www.oeaw.ac.at/ita/fileadmin/epta/countryreport/flanders.html

[4] This statement was made at the meeting of the EST-Frame project, Den Haag, 12.-13.09.12.

[5] Another indicator of the changes to which we point can be taken from Science and Technology Studies and analyses of the careful work to maintain the boundaries between science and politics (and law) through *boundary work* (Gieryn 1995, Jasanoff 2005). Compared to such analyses, the relations pursued by the technoepistemic networks have the character of *boundary engineering*, since they no longer try to keep the domains separate, but rather to join them together in projects of design and engineering.

by certain actors, or the prosperity and well-being citizens, users and communities are intended to gain from technoscientific innovations. Indeed, some of the observations from Epinet pertain to pervasive forms of 'quasi-integration', in which only a limited set of actors and networks are actually invited to the driver seat of techno-political innovation, while others among the European citizenry are expected to simply follow suit. The premises on which new social realities, communities and publics are meant to take shape, are largely left out by key policy initiatives like the Horizon 2020 agenda, or they come into the picture too late.

The lack of adequate public institutions may by itself result in problems and conflicts as technologies become implemented, and as actors are supposed to collaborate across national and professional boundaries without the support to achieve sufficient degrees of understanding and lines of good communication. This was one main finding from our investigations into networks devoted to smart grids and energy transition across Europe. Several participants in our workshops underlined how there is no lack of technological solutions, however, an almost complete lack of societal and political institutions to coordinate efforts between countries (Van Der Sluis et al. 2014). Hence, technological innovation without corresponding political and legal institutions, may end up as poor investment, since there is no way in which society at large, publics, users and local communities, may effectively and realistically connect and interact with each other [6] in order to address the shared challenges faced by Europeans, in this case energy transition. In that sense, the requirements and precepts of RRI (see introductory section) remain an outstanding unresolved challenge.

Science, law and assessments come under pressure

The above developments pose decisive challenges for technology assessors and for those aiming to achieve more responsible research and innovation, including also people working in governance, policy-making and publics seeking to engage with research and innovation. Analyses from history (Shapin and Schaeffer 1985), sociology (Latour 1993) and philosophy (Toulmin 1990) point to how western societies have, in their search to legitimate their actions, relied on separations between law and science, nature and politics. Granted, these relations were always more complex in real life than in their idealised official versions. But these idealisations also performed real functions, exactly by imposing some checks and balances between the different domains.

Within the activities of the technoepistemic networks, and through the breaking down of silos in a number of areas, these separations and modes of legitimization are no longer as strong as they once seemed. In their place we observe visions and promises to reform societies along more prosperous, sustainable lines of technoscientific research, innovation, living and producing. We are also starting to gleam the emergence of new societal relations in certain areas shaping around these networks, such as increased

[6] Similarly, participants at the same workshops complained about a huge number of pilot projects on smart grids and smart meters, but few efforts at real coordination of results, standards and technologies.

reliance on privatized health care provisions, pressures towards “responsibilisation” of patients, citizens and consumers (of energy, health care, and others); we also see communities and individuals taking things into their own hand through self-care groups, the quantified self movement, or new micro-grid communities for local energy production.

Main questions still remain about the sources of legitimacy that will in the end serve to prop up such new-emerging socio-technical orders. But neither is it the case that all previous structures evaporate: science and law are still crucially relied upon for the making and running of the networks, and new relations are forged with technology assessors and publics, for instance through public engagement activities. The new relations in which technology assessors find themselves are indicative of new roles for expertise, operating both within and across previous structures. What Epinet has first and foremost observed are the ways in which new and old forms of expertise are working to find their place within the new relations taking shape around the technoepistemic networks. We observe how lawyers and scientists assert themselves within new transdisciplinary configurations and take on new tasks; we observe how they seek out, and to some extent achieve, collaborations in new interdisciplinary teams; we observe how they come under pressure from policy makers and industries and their agendas to increase competitiveness and innovation.

Within such new constellations, assessors of science, technology and society relations, are also struggling to find their place. Main tensions relate to the need to remain both policy relevant, to be listened to and to get a place at the table, whereas at the same time retaining academic standing and the crucial independence (not to be confused with neutrality) from the very forces one is trying to understand and influence. Hence, the prospects of achieving more Responsible Research and Innovation are promising. And, the project of pooling the resources of the different epistemic communities of assessors may indeed be necessary, if some real influence is to be achieved within the ranks of networks that are strongly driven by industry, politics and powerful technologies. At the same time, these very developments raise doubts and criticisms from within the ranks of the concerned disciplines, such as TA, STS and ELSA.

A final corollary of this analysis, to which Epinet has devoted Work Package 2, concerns the pressure to achieve practically in realising the broader goals of responsible and sustainable research and innovation. Interdisciplinarity is at best the partial outcome of such work, far from being the default orientation from which assessors of science and technology, innovators and other relevant parties start their collaborations. This becomes visible in and through our findings. For example, interdisciplinary collaborations are indeed doable, however, in need of sufficient time, well-argued occasion to come together and a level of trust which can only be established in and through communication and togetherness. Even as urgency is used to push new relations across knowledge domains and experiences, one main outcome of our research is that disciplines respect their own disciplinary commitments in order to retain

legitimacy within multi-disciplinary contexts. If assessors have to sacrifice basic presuppositions and commitments, they lose hard-earned authority. Correspondingly, other practitioners lose the possibility to hold them accountable according to publically available validity claims. The result of that would be a deterioration of the authority of assessments-for-policy.

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