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# The role of FTA in responding to grand challenges: A new approach for STI policy?

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The Fourth International Seville Conference on Future-Oriented Technology Analysis (FTA) held in May 2011, focussed on the need and potential of FTA to address disruptive transformations in global and national structures, systems, rules and practices in response to grand societal challenges. This introductory paper provides an overview of selected conference contributions and the perspectives in which they address key issues in the development and implementation of FTA in relation to these challenges. These papers examine the reorientation of research and innovation systems and the integration of FTA within them. New approaches to FTA are also examined, with lessons drawn from the experiences at both national and international levels in the application of FTA.

The Fourth International Seville Conference on Future-Oriented Technology Analysis (FTA) entitled ''FTA and Grand Societal Challenges: Shaping and Driving Structural and Systematic Transformations'' organised by the Institute of Prospective Technological Studies of the European Commission's Joint Research Centre (JRC-IPTS) was held in May 2011. This edition of the conference focussed on the need and potential of FTA to address disruptive transformations in global and national structures, systems, rules and practices in response to grand societal challenges.

These grand challenges include the dynamics of demographics (ageing and migration), food supply, environmental sustainability, climate change, decarbonised economic systems, poverty, terrorism, not to mention the continuing fallout from the long-running 'global financial crisis':

> Transformations can occur in the form of disruptive events (i.e. unexpected, short-term and sudden events, with immediate and ongoing impacts, for which we are usually unprepared), ongoing processes (i.e. difficult to detect processes since change is gradual, with slow diffusion and with medium to long-term impacts), or transformation by design (i.e. change processes that are planned, such as social or economic structural transformations). Drivers of dynamic processes of change and sudden disruptive transformations range from rapid technological changes to shifts in social norms, values and lifestyles. Current and future societal challenges as well as their combination emerge from such transformations and call for appropriate forms of FTA to support and enable both organisations and individuals to anticipate, adapt and respond pro-actively to change.[1]

A closing summary of the FTA Conference outcomes in relation to policy needs by Georghiou (2011) highlighted the extent to which the global scale, complexity, and 'wickedness' of grand challenges poses a fundamental problem for existing governance structures. Historically evolved systems of national and international public administration demonstrably have fundamental difficulties in addressing grand challenges—that is not the kind of universe they were designed to handle. Hence the essentially accommodation responses that have been demonstrated—'we know how to negotiate treaties so that is what we will

do'; 'we know how to regulate if only the experts would tell us what we need to regulate'—are no longer sufficient. Nowhere is this impotence more apparent than in the response to the issue of climate change which confronts us.

A direct implication of this perspective is that while the effort committed to advancing FTA as an adaptive tool (assisting governments to plan for incremental change) have been useful, there is a desperate need for new tools, for experimenting different application and combination of existing tools and aligning them to governance systems, to address the complexity of the grand challenges. Sadly, the experience of international organisations established to provide a supra-national mechanism for addressing such issues suggests that these models are incapable of engaging with such issues. A tentative claim might be that FTA and the issues it brings to prominence need to catalyse major innovation in organisations and governance.

One particular feature of the 2011 FTA Conference was the organisation of two invitation-only sessions devoted to good practice in foresight for policy. The key aspects of these sessions were: the selection of a limited number of policy-relevant posters, based on the experience both of individual countries and international organisations; the invitation to policy-makers and experts to provide an informed audience for the poster presentations; the format of brief presentations followed by active exploratory discussion between the presenter and policy-makers; and a concluding discussion to identify major issues and findings.

The agenda was built around five key questions: what kind of emerging issues should FTA seek to address, which actors should be engaged, what actions should or could be taken, what is the possibility and role of innovation, and what are the key policy messages.

The criteria identified as being important for foresight specialists to achieve effective policy engagement were deep knowledge in the relevant field, a 'roadmap' style of thinking which served to translate possible futures into a schema that is both comprehensible and actionable, a high level of imagination and openness to new ideas, a practical understanding that not every idea will achieve immediate impact, but may be used at a later date, and clear ownership by a relevant 'client'.

A number of major trends were identified. These included the continuing adaptation of FTA to the changing economic and policy environment. This is instanced by the recent reframing of FTA from contributing to evidence-based policy towards a greater emphasis on the construction, analysis and interpretation of narratives.

Another significant shift is from primarily expert-based approaches to continuous highly participative 'crowd-based' processes. The growing use of horizon scanning and collection and analysis of weak signals and wild cards has been facilitated by the rapid expansion of social networking capacities and online tools, and the ability to capture and analyse very large sets of data.

Significant methodological and even philosophical tensions are arising as a result of this shift. Open processes based on high levels of participation allow for far greater input of information from different perspectives, but run the risk of a decrease in quality control and lack of adequate analysis of the knowledge generated —an illustration of the tension between the managed expertise of scientific processes, and the mass input from a large variety of variously informed or uninformed sources.

Another tension is that between the ideal rational objective stance, philosophically impossible but still a useful guide to the construction of reliable knowledge, and an engaged activist stance driven by particular values, which however worthy, are open to rejection as biased and self-interested.

This special issue assembles a selection of papers addressing these issues from three main perspectives:

- systemic change, re-orienting the research and innovation system towards major societal challenges, with greater integration of FTA;
- the development and implementation of new approaches to FTA, particularly the application of horizon scanning;
- experiences of particular organisations, operating at both national and international levels, in applying FTA to their own innovation activities as well as those of key stakeholders.

Embedding foresight into and across national, and increasingly transnational, research and innovation systems can be seen to offer the most effective approach to meeting cross-cutting societal challenges.

Cagnin, Amanatidou and Keenan address the roles that FTA can play in orienting the innovation system to more effectively address the grand challenges. In their view, FTA can facilitate experimentation and learning by providing safe spaces for new ideas to emerge and existing knowledge to be combined in novel ways. As a source of strategic intelligence, FTA can support the development of knowledge by providing, for example, insights on longer-term developments, the scope and opportunities for shaping futures, and the mutual positioning of innovation system actors in relation to the future. At the same time, FTA can support and reinforce the emergence of 'hybrid fora' that bring together diverse and often disparate actors that might not normally interact. These allow for knowledge to be created, exchanged and diffused.

Weber, Cassingena Harper, Könnölä and Carabias suggest that addressing the grand challenges requires a new kind of FTA. These are driving governments and businesses to shift FTA activities from individual large-scale foresight programmes and projects, to investing in developing in-house competencies for coping with sudden change. A tighter embedding of FTA in support of decision-making is needed in the context of a fast-changing, turbulent and complex environment. There

are also internal drivers for the emergence of novel forms of future intelligence which are linked to the need to achieve coordinated and coherent decisions within and across organisations. As a consequence, there is a growing need for the capacity to anticipate change to be centrally embedded in policy- and decision-making, and to achieve this embedding quickly and strategically.

Keenan, Cutler, Marks, Meylan, Smith and Koivisto take the view that science will play a key role in society's response to emergent global grand challenges such as resource scarcity and global environmental change. Science itself will also be a source of new challenges but also opportunities through its contribution to technological change in areas such as: the transition to a sustainable society, health and lifestyles, agri-food or the development of new defence tools. The agenda-setting, coordination and conduct of science, and the ways in which scientific knowledge is diffused and used, are therefore critical issues. Keenan et al. report on the application of FTA by the International Council for Science when considering its most appropriate role in this new situation. The scenarios that have been developed provide important insights into organisational options for international science and the roles that science, including the social and human sciences, could play in addressing future global grand challenges.

Ahlqvist, Valovirta and Loikkanen describe the development of a new policy instrument, innovation policy roadmapping, and its role in assisting in aligning technological and societal perspectives with the more visionary framework necessary to address grand challenges. This instrument adapts the methodology of technology roadmapping to addressing critical innovation policy challenges at the level of national and regional innovation systems, within a global context. Significant features are that it is targeted at the systemic level of multiple actors and organisations, so that the visionary process includes many participants and different interests, and it combines analysis of enabling technologies, applications, products, markets and drivers with empirical analysis of the policy instruments that are currently utilised. The outcomes of the process can be strategies to implement a novel policy instrument or a strategy for a region to engage in an active market creation in the context of some promising emerging technology.

Könnölä and Haegeman focus on the coordination challenges in the design and implementation of transnational research programming, particularly in the context of concerted transitional efforts to address major societal challenges. They specify the key dimensions of transnational, vertical, horizontal and temporal coordination required and the role that FTA can play in helping to address the inherent complexity. Drawing on evidence from three cases on foresight processes in research programming, they highlight both the value that FTA can bring to the programming process, and also the challenges posed to foresight design and management. They elaborate three central guiding foresight principles: scalability, modularity and flexibility.

The value of novel approaches to FTA to more effectively identify, understand and thus respond to grand challenges has been addressed in two of the papers, with a particular focus on the application of horizon scanning. Amanatidou, Butter, Carabias, Könnölä, Leis, Saritas, Schaper-Rinkel and van Rij argue that FTA methods can provide important enabling early warning signal detection and pro-active policy action which can assist policy- and decision-makers in today's complex and inter-dependent environments. The authors provide an analysis of the effectiveness and limitations of a number of different horizon scanning approaches applied in a European Commission funded Framework Programme project (SESTI). A comparative analysis is provided as well as a brief evaluation of meeting the needs of policy-makers to identify areas to intervene in by formulating appropriate policy.

Könnölä, Salo, Cagnin, Carabias, and Vilkkumaa discuss key issues in harnessing horizon scanning in order to shape systemic policies to address major challenges. Due to the increasing complexity of modern societies, policy-making institutions face growing challenges when seeking to address emerging issues in a timely manner. This is particularly true in policy contexts where the issues are not yet prominent on the policy agenda and where the requisite actions must be implemented early on to ensure success. In such contexts, various forms of horizon scanning offer tested approaches for identifying signals that indicate emerging issues. But mere listing of such signals does not necessarily support the formulation of policy issues or, more broadly, the development of coherent policy themes which can be tackled through policies that span areas of administrative responsibility.

In general, horizon scanning activities for the shaping of systemic policies involve three key questions: how to facilitate the recognition of signals and the elaboration of corresponding policy issues; how to synthesise such signals and issues into meaningful collections; and how to facilitate collective sense-making in their analysis which is relevant to policy recommendations? They draw on the foresight exercise 'Facing the future: Time for the EU to meet global challenges' (Boden et al. 2010) to illustrate how horizon scanning can enable collective sense-making processes which assist in the identification of emerging signals and policy issues, the synthesis of such issues into encompassing clusters, and the interpretation of the resulting clusters as an important step towards the coordinated development of joint policy measures.

The experience of FTA practitioners in implementing foresight tools provides further evidence of the effectiveness of particular tools in meeting particular challenges in the most appropriate ways. Case study evidence is a core

feature of every FTA conference. The application of FTA in large research-based organisations in developing both their own strategic orientation and those of their clients, can offer wider lessons for both the organisational integration of FTA and the identification and continued evolution of good practices.

Cuhls, Bunkowski and Behlau provide a case study of the Fraunhofer Institutes' action-oriented foresight process of using global challenges to identify and implement research themes for future markets. Traditionally, the Fraunhofer R&D portfolio has been technology-driven. A corporate Future Topics process has been established in order to foster a needs-oriented approach. In 2010, global challenges were identified, analysed, re-structured and selected according to potential Fraunhofer contributions and market potential. Five challenges were subsequently formulated to serve as a frame for the new Future Topics programme. Within the programme, institutes are called upon to form consortia and develop interdisciplinary research projects to tackle these challenges. Collaboration and interdisciplinary problem-solving approaches are fostered as project consortia have to consist of at least four institutes, preferably with diverging technological competences.

Nehme, de Miranda Santos, Filho and Coelho provide a case study of the application of foresight by the Brazilian Center for Strategic Studies and Management (CGEE), over the past nine years. Key methodological elements are: the involvement of key stakeholders from the very beginning; clear establishment of objectives and strategic goals; and a planning approach that attempts to identify innovation application points. These features impact directly on the client's perceived ability and engagement. The paper emphasises the role of intangible values and 'out-off-the-box' thinking in order to attain success.

In summary, such complex and pressing issues as: adequately feeding a global population of six billion: understanding and preparing for the effects of climate change and the associated development of a decarbonised global economic system: and managing an ageing industrialised world and a 'youthing' industrialising world present truly grand, and wicked, challenges.

The contributions to this special issue, as well as to the FTA conference more generally, clearly demonstrate there is a growing volume of valuable and appropriable experience in the development and application of FTA, in terms of both the process and methods and the organisational context in which it is applied. This further reinforces the need to both share and review this experience and to draw and implement lessons from it in a more systematic manner.

It is increasingly evident that current governance structures, largely evolved in the 19th century, are clearly proving incapable of addressing such issues with resolve or speed. This is triggering a loss of confidence among the public not only with their elected representatives, but also with the whole apparatus of government. The emergence of the communication capacities of social networking technologies is itself providing a challenge to existing systems, and a means of by-passing them.

One response, based on introducing higher levels of flexibility into governance systems, is via a much more systematic embedding of FTA within government. In fact, FTA can provide safe spaces for new ideas to emerge and be experimented with. But this certainly also requires greater emphasis on an FTA which is less concerned to be 'adaptive' and supportive, and rather more concerned with a relatively new type of FTA with an emphasis more on 'thinking the impossible', and detecting and responding to early signals of potential dramatic change.

However, it has to be noted that FTA can challenge current systems and through its implementation it can explore for new approaches that might include incremental but also radical changes. It is therefore necessary that the stakeholders are aware of these possibilities and have an open attitude to changes in systems. These should not be seen as threats but as necessary evolutions to keep pace with wicked problems and challenges.

There is also an obvious need to adapt to, and take full advantage of, the potential for 'crowd-sourcing' processes. Recent progress in the use of horizon scanning and weak signal analysis indicate there is very considerable potential for establishing fast and effective 'sense-making' mechanisms which can concurrently identify and analyse emerging problems and generate a range of creative responses.

The challenge for STI policy therefore, would appear to be:

- acknowledgement of the deep inadequacies of vertically structured systems and processes, and much greater experimentation with the development of more horizontal mechanisms;
- embedding an FTA capacity designed primarily not to support incremental change, but to act as a warning and progenitor of disruptive change;
- acceptance of the enormous potential of processes using crowd-sourcing, including the diminution of central authority and legitimacy which necessarily accompanies it.

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## Notes

1. Introduction, Fourth International Conference on Future-Oriented Technology Analysis (FTA). <http://foresight.jrc.ec.europa.eu/fta_2011/intro.html> accessed March 2012.

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