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Introduction

From priority-setting to societal challenges in future-oriented technology analysis

Future-oriented technology analysis (FTA) is a term derived from a collective description given to the range of technology-oriented forecasting methods and practices by a group of futures researchers and practitioners [1]. Called "technology futures analysis" in its original form, the central aim was to bring into a single frame a family of methods and approaches that had matured and developed separately. A variety of antecedents could be detected for this initiative. A central reference was the CD-ROM Futures Research Methodology, version 2.0 edited by J.C. Glenn and T.J. Gordon which formed an authoritative source of methods to address [2]. However, many of these methods have far wider application in futures work than in the domain of technology and it is pertinent to ask why there should be a particular focus on technology. While this is a powerful undercurrent in the broader discourse of futures work it does not elsewhere form the central focus. In fact Slaughter made it clear in his review of a previous decade of futures studies that "As we look ahead it becomes increasingly clear that technical innovation on its own is not the main issue." [3]. On its own perhaps not but technology is rarely absent among drivers; as Linstone argued in the context of considering long waves, "Technology will play as significant a role in the 21st Century as it did in the 20th" [4].

From the conceptual ground of the paper, a biennial conference series developed, hosted by the Institute for Prospective Technological Studies (JRC-IPTS) of the European Commission Directorate General Joint Research Centre. In its first iteration in 2004 it was billed as an EU-US Scientific Seminar but the scope has since widened to be explicitly global. The focus at that time was research on improved methods, methodological choice, and merging empirical/analytical methods with stakeholder engagement processes [5]. The positioning was aimed at perceived overlapping fields of practice among technology foresight, forecasting, intelligence, roadmapping, and assessment. Two related issues emerged that were to prove persistent. The first has been a constant tension between, on one hand, an attempt to group and synthesise the approaches that in Europe at least are called strategic intelligence [6], and which here operated under the FTA banner and, on the other hand, a dominance both in papers submitted and in taxonomic terms of the "foresight" label. In successive conferences conclusions have noted this tendency to regard FTA as the name of the conference and foresight as the generic term for the field encompassing most, if not all of the approaches listed above. Certainly foresight papers have dominated numerically but the need to recognise the traditions of technology assessment, forecasting and other dimensions of futures studies remains important even if the field is not ready to tolerate a new collective term.[2]

This leads to the second persistent theme. As Mermet et al. have noted, the success of foresight in recent years illustrates the strength of what they describe as the "covenant between futures methodology and the needs of long-term strategic management and policy". [7] It is perhaps not surprising that a conference series that seeks to bring together futurists and policymakers in the domain of research and innovation gravitates towards a concept that in its construction already includes the participation of both communities. Ian Miles has sought to position foresight in relation to the broader canon of futures studies [8]. While acknowledging similarities to *la prospective*, he sees the main distinctive features of foresight from futures studies as lying in a link to policy actions, and drawing upon wider sources of knowledge than experts so as to use the broader participation not only to inform or to legitimate results but more proactively to embed them in the strategies of organisations across the economy and society.

In the development of the FTA series the notion of user engagement was to grow stronger. By the time of the second conference, the "impact of FTA approaches on policy and decision-making" had become the core theme and emphasis was placed on the delivery of concrete and valued policy outcomes and impacts from FTA activities. This was reflected in the

[2] This tension has been mirrored at the time of writing by an attempt by parts of the European Commission to put into wider usage the collective term they are using for internal managerial purposes, in this case forward-looking activities. The experience of FTA suggests that then new term will only have currency in the space and time in which it originated and that for wider purposes a dual definition of foresight as a broader umbrella and as a specific family of approaches will persist.

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eventual outputs. Two special editions of journals reflected the continuing methodological interest but crossed this with an interest in the evaluation of impacts and in the use of FTA in two domains, business and higher education [9,10]. However, the central output this time was an edited book.

In preparing the conference the scientific committee had concluded that a better focus could be achieved through the production by its members of ''anchor papers''. These would seek to review past work and orient the contributions (via an extended abstract on the website) to the selected themes to enable sufficient coherence to permit a productive discourse. The 2006 anchor papers formed the core of the book. In concluding the collection, Keenan et al. identified a number of dimensions in which to move forward which fell broadly into the categories of building the capacity and connectedness of the FTA community on the one hand and improving engagement with users on the other [11]. Such engagement would come from raising awareness of the benefits and limitations of FTA, in part through improved monitoring and evaluation, and through preparedness to address global problems.

It was against this history that the third conference from which this edition derives emerged. The 2008 FTA Conference continued the focus on the ''impacts and implications of FTA for policy and decision making'' but this time constructed its themes and anchor papers differently. For a conference that attracted 166 abstracts and accepted only 56 of them, there was always the opportunity for a rich vein of ideas to be mined. Specialised topics have been covered by special editions of other journals [12,13] but the anchor papers plus another which represented a cross-cutting theme emerging at the conference (tailoring foresight) have been put together here.

Georghiou and Cassingena Harper set out the terrain for FTA, and more specifically for foresight, in terms of its inbuilt concern with research and innovation policy or strategy issues. However, they argue that this engagement has sometimes been too narrowly perceived as being synonymous with the identification of broad technological priorities for investment. While this remains a goal for a minority of programmes, the paper sets out a number of inherent difficulties with this type of priority-setting which have underpinned a trend away from this objective and towards more structural concerns. These can include articulation within a field (as expounded by Schoen et al. in their paper) or use of these approaches to look at an entire research and innovation system. FTA approaches are also locked in a spiral of co-evolution with research and innovation policy, finding new applications in aligning actors around societal challenges (as described by Könnölä et al.) and in demand-side innovation policies while also influencing the development of those policies.

Schoen et al. address recent developments in foresight theory and practice which lead them to deploy a hybrid methodological framework involving tailored approaches for specific purposes and/or phases of a foresight activity. Both context and objectives are taken into account in improving strategic processes of priority-setting, networking and vision-building, not across the broad front of technological options but within specific sectors. They take into account the specific characteristics or what they call the 'field-specific knowledge dynamics' and the institutional arrangements pertaining in that field. Their guiding principle is 'no one-size fits all across sectors. They argue that this tailored approach should be adopted in the development of the European Research Area.

Könnölä et al. put forward a framework to clarify different roles of foresight within the system and their respective impacts and implications for policy and societal developments. These roles are identifying promising technological pathways, engaging relevant stakeholders and creating common visions that move into action. Among FTA tools foresight is posited as the most suitable for providing policy support to address major societal challenges. Echoing Georghiou and Cassingena Harper they see a shift from positivist and rationalist technology-focused approaches towards recognition of broader concerns encompassing the entire innovation system including societal perspectives.

Addressing the theme of methods and tools Eerola and Miles come to the topic from the perspective of knowledge management but their interpretation of the core of that topic as set out by Nonaka and Takeuchi [14] focuses on the ways in which individuals who address the future share their knowledge and link, present and discuss information and insights with each other. This picks up the point above, that stakeholder engagement and participation is at the core of foresight activities but also emphasises that this does not happen simply by bringing all the actors together. They map FTA methods in terms of the ways in which they process information and deconstruct the scenario workshop process in detail to illustrate the organisational learning and spirals involved.

The need for more participative and inclusive decision-making is also emphasised by Cagnin et al. As with Könnölä et al., they see a shift from technocratic to wider democratic processes of decision-making as societies respond to globalisation and the societal challenges which ensue. They call for a better understanding of issues to be considered by the FTA community so that it can support the quest for new forms of governance. They structure these into three pillars: socio-cultural evolution, corporate industrial activity and government. Continuing the call for the FTA community to move on from identifying priorities, the paper concludes by advocating the need for embedding forward-looking participatory practices in overall processes of strategic policy and decision making.

The special edition concludes with two contributions that sought to take advantage of the confluence of futures expertise brought about by the conference. Saritas and Smith invited attendees to answer a number of questions about shaping forces, sources of change and their impacts, particularly in terms of new challenges and opportunities. These questions were structured into the categories of trends, drivers, wild cards, discontinuities and weak signals. The survey responses provide a rich and diverse array of issues that could be further dissected and analysed by future foresight activities. Concluding the edition, in a short essay, Johnston and Cagnin review the main findings from a series of interviews about the status of FTA as an activity with nine personalities attending the FTA conference. These mapped a picture of FTA as an increasingly important approach in many countries across a wide range of challenges.

In Spring 2011 the fourth FTA Conference will take place. The conference focuses on the knowledge triangle of research, higher education and innovation.

From a forward looking perspective, special emphasis should be given to the combination of quantitative and qualitative methods applied as support to a well functioning knowledge triangle, and to the increasing role of modelling and simulation in developing a better understanding of complexity and supporting evidence-based or evidence-informed policy making.

The conference will seek to understand further how far the institutionalisation (i.e. embeddedness) of FTA supports both the achievement of measurable impacts and the strengthening of interaction s between research, higher education and innovation. In addition the conference aims to debate the use of horizon scanning as a process that enables policy to explore actively emerging challenges and trends and how these address or are related to the grand challenges faced by societies today and in the future.

Moving forward the edition has shown FTA to be in a transitional stage brought about both by its internal dynamics and by the broader global environment. Economic, social and sustainability challenges have created a new and more demanding agenda for research and innovation policymakers and strategists. A further demand is for more equity and cohesion. The pressing need to mobilise resources around societal challenges exposes the limitations of technocratic approaches and emphasises the need for the kind of participatory approaches that foresight in particular can offer. Tailored approaches are needed that reflect the varied and complex structures of sectors and those who hold a stake in cross-cutting themes. Methods in turn need to manage the complex knowledge flows that are entailed. FTA is a work in progress but represents a dynamic section of the futures community.

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