Foresight: Turning Challenges into Opportunities

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For many years, foresight has been used as an instrument for elaborating forward-looking strategies and policies, primarily in the science, technology and innovation (STI) domain (Johnston 2002; Keenan 2003; Keenan and Popper 2007). It has become a frequently used concept for preparing governments, businesses, research institutions, universities and non-for-profit organizations across the world to address potential future challenges.

Theoretical and methodological studies, as well as analyses of best practice cases, have enriched foresight tools and their applications across a wide spectrum of fields and areas. Extending the scope of foresight beyond its initial exclusive focus on STI (and especially on R&D), by looking at socio-economic and environmental trends and taking account of skills for STI, entrepreneurship, and other cushy topics, has provided an important feedback to the design of anticipatory STI policies (Sokolov and Chulok 2012). Academics and practitioners agree that although each foresight exercise is in many ways unique, there are several major 'mainstream' approaches which provide meaningful lessons to learn (Meissner et al. 2013). Thus, foresight used as an instrument for strategic STI planning in companies usually has a comparably short time horizon (with the exception of the largest companies in the energy, aerospace and other sectors with long-term innovation cycles) is allocated fewer resources and engages fewer stakeholders than that undertaken by public bodies. Foresight produced by government agencies to identify priority areas for STI either at the national level or in individual sectors tends to cover longer horizons and have a broader scope, involving more stakeholders. National STI foresight studies are the most complex in this respect (due to the increased coverage of sectors, technological areas and scientific disciplines) and require significantly more resources.

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Foresight is most often applied to identifying future applications and markets and their subsequent demands for particular technologies. Therefore, the challenges analyzed vis-à-vis technological trends (such as market pull vs. technology push) enable both businesses and researchers to identify the directions needed for forthcoming actions (van der Steen et al. 2011). Governments are provided with a better knowledge of the fields of basic and applied science which should be supported in the long-term.

The main ambition for applying foresight for countries' STI policy formulation and also for corporations' strategy development is to reflect on potential changes which might impact the nations and its businesses. Hence foresight is implemented to raise awareness about the potential short-, mid- and long-term developments expressed as challenges and opportunities (King and Thomas 2007; Martin 1995). Many individuals and businesses will seek to develop routines which help them **avoid** the challenges, predominantly for a short-term period of time and not always successfully, rather than **addressing** them (Sokolov 2009). Consequently, an approach evolves which focuses on threats to individuals, companies and societies instead of stressing incentives to develop initiatives that tackle the challenges and create new opportunities that may last for a long run. Though at an aggregate level, namely at a policy level and at company corporate level, the challenges including their expected impacts and threats are better understood. Nonetheless, this paradigm eventually generates and supports individual passivity, whereby, despite watching and monitoring the development of the challenges, and despite experiencing their growing impact, many actors still remain inactive.

The issue now is to integrate these challenges in the strategic orientation of national STI and of companies and to derive suitable measures to meet them and most important to implement such measures. In this regard it is important to remember that innovation stems from people's activities which in turn are driven by their ambitions and incentives to search for new solutions. The latter are reasonably different between people including: curiosity, a personal drive to do something new, and also a sense of what psychologists term "internal control". It is the attitude that one can shape the world and that a challenge is there to be solved and overcome. Consequently, STI policy and company strategies should take into account the ambitions of economic actors engaged into various links of an innovation chain, from the very early stages of interventions.

STI policy has focused on—in addition to support for R&D—infrastructures, regulations, and framework conditions of national innovation systems. Occasionally, public perceptions of STI have also been taken into account. Although skills issues are frequently discussed in STI debates, little attention has been paid to underlying personal attitudes and characteristics of individuals in the STI system. But knowledge of individuals' behavior and routines helps to achieve ambitious targets. This knowledge means that one can appreciate the provisional impact of possible STI policies. It is important nonetheless to understand not only people's motivations concerning STI, but also the potential objections and resistance towards proactive STI policy measures. The latter is especially important when it comes to policy actions which might affect established structures and routines

referring to individuals, households, businesses, non-for-profit organizations, or governments (European Commission 2009).

Logically then, it follows that expectations towards STI actors continue to grow. The underlying assumption is that investment in STI generates economically viable innovation. Consequently STI policy aims to assign human, financial and material resources to selected fields of STI by setting respective priorities and by designing framework conditions that allow to enforce the exploitation and commercialization of science and public research. In light of the challenges detected and described by foresight and the desire to generate quick responses in particular, policy takes into account the fact that actual inspiration and academic freedom play limited roles. A switching of mindsets away from thinking in 'challenges' towards thinking in 'opportunities' therefore cannot be achieved merely by setting financial incentives, instead, this task requires to publicly recognize and reward individuals. In this respect, it is increasingly clear that STI policy and company strategies need to address the soft skills of human resources to design and implement initiatives addressing the challenges and that the private sectors credits the public sector overall contribution to enhancement of knowledge and science (Gokhberg and Meissner 2013; Meissner and Sokolov 2013).

Part I of the book discusses the potential and actual roles of foresight in the development of STI strategies, namely at a company level. The special features of national level **foresight are introduced in Part II. Part III highlights foresight in the broader STI policy context,** with a clear focus on switching the mindset from challenges to opportunities. The concluding **Part IV provides a framework for seizing opportunities for national STI development.** This final Part also provides an outlook on future developments of corporate and national foresight and how they could be implemented in innovation management and national STI policies respectively.[1]

Part I discusses **anticipatory strategies.** *Saritas* finds that monitoring trends is an important step for foresight activities and gives the first indications of emerging future developments in society, economy, and technology, and provides valuable inputs for future-oriented, strategic decisions at the levels of public and corporate policies. He considers how to integrate the results of the trend monitoring into processes of designing STI policy and business strategies. The chapter also spells out the practical aspects of how—and in what form—trend monitoring outcomes should be delivered to the target communities of policy makers and business planners.

The emergence of trends is naturally dependent on the diffusion of technologies and the role of stakeholders in the diffusion process. *Meissner* argues that STI strategies largely aim to support the diffusion of technologies and innovations in

[1] This volume complements an earlier book by the editors "Science, Technology and Innovation Policy for the Future: Potentials and Limits of Foresight Studies", Springer 2013. It summarizes the results of a high-level international conference "Foresight and STI Policy" hosted by the Institute for Statistical Studies and Economics of Knowledge, National Research University Higher School of Economics in Moscow, October 30–31, 2013.

commercially viable applications. The eventual impact of implementing these strategies is strongly influenced by a variety of stakeholders. However, the number and variety of stakeholders are not the only factors important for STI strategy; the agendas of stakeholders also matter. In the author's view, stakeholders may at first sight support the diffusion of technology yet their actual intent is different: the resulting activities potentially obstruct—instead of enforce—diffusion. The reasons for this are manifold. Frequently, while competing technologies are compared and competitive analysis is carried out, the overall infrastructure surrounding the technologies is insufficiently taken into account. This turns out to be a major barrier for technology diffusion and is driven by the stakeholders' hidden agendas. Hence in developing and implementing a technology diffusion strategy, it is important to systematically analyse stakeholders' agendas from all possible points of view.

The integration of foresight into corporate strategy-making raises special challenges. These include the compatibility of data and information collected through foresight with the standards required for corporate planning. The frequency of foresight and planning exercises is another issue. *Linton* and *Walsh* demonstrate how to integrate foresight with corporate planning as a way to help organizations understand what might be required in the future. Their chapter proposes a framework for determining the state of current and future competencies and capabilities of companies.

Setting the right priorities for STI activities is an issue of outstanding importance, especially for companies in knowledge intensive industries. The challenges mainly relate to how to build and maintain competencies for future oriented analyses of a company's external environment; how to achieve developments that have a positive impact on the companies' operations; and how to align the naturally different time horizons of corporate planning and future oriented strategic intelligence. The latter issue is particularly pertinent for commercial organizations in emerging and transition economies. *Vishnevskiy* and *Karasev* discuss the meaning of corporate foresight for innovation management and the interactions between corporate foresight and the corporate innovation process. They demonstrate the potential of corporate foresight for companies and also highlight the limitations of this approach.

Cordeiro provides an interesting comparison between the evolution of human beings and how this constant evolution causes ongoing changes in humans' routines. Changing routines, he argues, is mainly caused by evolution which uses technological progress as a tool for changing the status quo. A change—and hence technology—is not limited to narrow fields of application; it also causes secondary impacts which ultimately affect the broader set of routines. In this regard, we can assume that foresight and allied forward-looking activities potentially create a 'domino effect' on STI policy measures. In other words, it could be that foresight results have broader impacts on policy measures than usually expected.

Part II provides an insight into **different national foresight approaches in transition countries**. The chapter involves a rare collection of foresight studies undertaken at a national level. Governments in transition countries seem to be

aware of the potential of foresight for designing national STI policies and for analyzing the strengths and weaknesses of national innovation systems. On the other hand, there is a widespread belief among stakeholders that their activities are sufficient for their country and that global trends have no (or only slight) impact on national innovation systems.

In their review of the process and results of foresight exercises aimed at identifying research priorities in South Africa, *Pouris* and *Raphasha* illustrate this contrast between government and stakeholder perceptions. They argue that national stakeholders in South Africa do not recognize the importance of emerging technologies and their respective impacts on economies and nations at large. foresight studies carried out in South Africa clearly show how the country is integrating itself into the global economy and is beginning to create awareness among key stakeholders about these developments and the need to identify national policies that respond to the resulting challenges.

Brazil has designed foresight in a way that explicitly positions societal actors as those able to develop the innovation system in directions that are crucial for addressing future challenges. *Cagnin* provides an insight into special Brazilian foresight features such as promoting transformative change to increase the relevance of foresight and its impact on decision-making processes and on the design and implementation of STI policies in Brazil. The Brazilian approach is intended to spark the imagination and expand collective understanding to better comprehend the present situation. It is assumed that this thorough understanding of the situation provides a solid platform for implementing policy measures to reorient the country's national innovation system. Achieving this ambitious goal requires a broad range of different competencies and positive attitudes of the actors involved to realistically assess the status quo.

To bring the relevant competencies together for a comprehensive assessment of the current situation and the potential development paths, the Russian Federation has developed and implemented a National Technology Foresight System. This is the subject of the chapter by *Chulok* who shows that a national foresight system integrates numerous actors with different affiliations from the country's existing competence centres. These are methodologically supported and coordinated but not centrally managed, and thereby decentralized competencies are leveraged. In addition this encourages competition between those specialized centres; which in turn also provides leverage for quality assurance of the respective foresight activities. The challenge imposed by such national systems of combined expertise is to ensure that the independent units follow similar approaches of foresight and that the results are comparable. Moreover, a national inventory / depository of foresight studies carried out by decentralized units would be beneficial and make the knowledge and experience acquired by these studies publicly shared and accessible to a broad national network.

In recent decades, South Korea emerged into a high tech country with a reasonable number of global industry leaders in several technology and innovation fields. This achievement is traceable—at least in part—to the remarkable history of foresight at the national level which was used for STI priority setting in all relevant

spheres. *Moonjung Choi* and *Han-Lim Choi* explore how foresight in the entire field of science and technology has become a key process in national STI policy, resulting in key national initiatives such as the Science and Technology Basic Plan. The latter is not just a formal legal document, but a mandatory planning process established every 5 years by the Korean government, and it is the top-level plan shaping STI-related policies in Korea. It selects the national strategic technological priorities through reflecting on future technologies identified by foresight studies. The most recent South Korean foresight not only has a technological dimension, but also takes into account the development of society, its changing needs and desires, and the resulting implications for technology acceptance and diffusion.

Building a strategy that is related to STI is always done under a significant uncertainty regarding the intended outcome; therefore, it is a process associated with a reasonable risk. *Calof* and *Smith* argue in their chapter that while—at the moment of developing an innovation strategy—there might be demand for the intended outcome, this might change over time. For example, the demand could have been met by competitors. One approach to limit such risks is to integrate foresight, technology intelligence and business analytics into the initial design of strategies and to continuously monitor the external environment. Initially, this integrated approach was designed for companies' innovation management. Yet, the authors show that the integrated intelligence process also has potential for targeted STI policy.

Foresight and STI policy share several features. In principle, STI policy is targeted towards the future development of nations and societies by designing anticipatory policy measures which prepare countries for meeting future challenges at different levels. In this respect, STI policy should take an active role rather than merely reacting to current challenges only. STI policy measures certainly impact countries' STI but these impacts are frequently hidden and occur over a long time horizon. Decisions about and investments in STI priorities are always made under uncertainty at company and national levels. While foresight or similar activities have been already embedded in corporate STI strategies and priority setting, there has been still a lot to be done at country level. To date, it has become common practice in developed and emerging countries to use foresight for different purposes but the integration of foresight into the STI policy context remains a weak point. Therefore, **Part III** explores **the integration of foresight into a broader STI policy context**.

Using the example of Horizon 2020, *Harper* explores the potential of foresight and forward-looking activities in a STI support programme. She argues that foresight takes numerous roles in the design and implementation of an impactful support programme. This is mainly due to the numerous iterations in the design process and the decomposition of one huge programme into numerous sub-actions, which are all case-specific and targeted to different challenges. To meet this challenge, foresight takes a strategic, instrumental and operational role in the design and inception of the STI policy measures. However, the design of foresight in light of the EU Horizon 2020 programme needs to be carried out in a way that is

sensitive to respective national environments and specific framework conditions which apply there. Horizon 2020 is a significant STI policy instrument designed and implemented by a multinational institution which naturally also reflects the interests of member states to some extent. Although, the approach chosen is not immediately transferable to countries' national foresight exercises, there are numerous positive lessons to be learnt by national policy makers.

Seidl da Fonseca provides an inspiring insight into the design and the final assessment of foresight at national levels by proposing a model for foresight assessment and for comparative analyses of STI foresight's impact. Particular country cases demonstrate a variety in methodological approaches and implementation schemes applied to foresight studies around the globe.

Each industry sector has particular features which require a dedicated tactics for futures thinking and foresight respectively. In particular, the services industry covers a broad range of different activities, and moreover, as *Miles* describes, beyond some traditionally recognized purely service activities there are also those which accompany manufactured products. In the latter case, services are thought to generate an additional value to a conventional product and hence provide a competitive advantage to the supplier. Both forms of services are close to the customer which means there is an opportunity to obtain an immediate user feedback. Services are also typically designed for the user and take into account users' wishes and requirements. Accordingly, Miles aligns foresight and futures studies to the features of services and the characteristics of innovation in services.

The capabilities of countries to meet global challenges and to turn a 'challenge-based thinking' into 'opportunity-based thinking', however, are not achieved at the national level. Rather, these capabilities emerge regionally. The exclusively regional (or even the city) level is much closer to value creation than the rather abstract, national (or federal) level. In fact, local networks are essential ingredients to broader value chains which may even obtain a global dimension. *Erdil* and *Goeksidan* show the potential for small and medium-sized companies of participating in global markets by means of integrating in local value chains. Such value chains display the local or regional networks which frequently change in their shape and orientation, and which often determine the overarching national competitiveness. Accordingly, these networks frequently assess their competitive positions and, more importantly, look for indications of future trends which might offer them new options to participate in global market activities.

In the **fourth concluding Part** *Gokhberg and Meissner* look at ways to benefit from STI. They argue that although there remains a need for designing a consistent and coherent STI policy approach and policy mix, the real challenge is to change the perceptions of the functioning of STI which is a pre-condition to achieving social and economic impact and value. This change is a shift from 'Thinking in Problems' which is characteristic of scientific work towards 'Thinking in Opportunities'. The latter still describes forward-looking activities but comprises of decomposing problems, searching for dedicated solutions, and developing necessary interfaces for integrating the latter into systemic strategies which are applicable to the initial agenda and not targeted at features of separate problems being

taken on an individual basis, as usually implied in the 'Problem Thinking' mentality. The issue of changing mentality needs to be addressed at a policy level as well as by the STI communities.

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