Guest editorial

Thomas Thurner

Thomas Thurner is Professor at the Institute of Statistical Studies and Economics of Knowledge, Higher School of Economics, Moscow, Russian Federation.

Introduction to the special issue: science, technology and innovation prospects for Russia

Policy makers face the challenge to invest public funds effectively into key priority areas. To identify such high-impact technological fields, foresight studies have emerged as increasingly powerful tools (Rohrbeck and Schwarz, 2013) to provide much-needed support. This rise of foresight as an instrument of science, technology and innovation (STI) policy was facilitated by great methodological advances over the course of the past decade. Already in the 1970s, practitioners searched for methods to properly forecast technology developments and to put them in the context of the socioeconomic environment. During the 1990s, first exercises methodologically identified critical technologies of national importance. In the mid-2000s, large-scale systemic foresight studies came into use in Russia, and the first revision of the list of critical technologies was approved by the Russian President in 2006. This was followed by the first national science and technology foresight study over the years of 2007-2008.

Ever since, foresight exercises expand rapidly into different areas, from national levels to sectoral economic activities (energy, aircraft industry, shipbuilding, water supply, information and communications technologies (ICT), health and many others), to means to identify possible regional development paths. Foresight has also become appealing to large-scale state-owned enterprises, which play a pivotal role in Russia's economic development (Gershman and Thurner, 2016; Thurner and Roud, 2016). These activities demonstrate the potential of foresight as a strategic tool for decision makers at different levels and spurred attempts to better coordinate the efforts on a national and an international scale. In 2013, an Interministerial Commission on Technology Foresight was established under the auspices of the Minister of Education and Science which brought together engaged key stakeholders (mainly at the level of deputy ministers and vice presidents for innovation of large companies and a few key experts in the field of foresight).

Recent contributions have paid interest to different technology foresight systems (TFSs) in place (Dreyer and Stang, 2013; Schmidt, 2015) and in ways to make individual foresight practices accessible, while studies on different country specifics or organizational setups have provided insights on certain organizational aspects (Georghiou and Keenan, 2006; Rohrbeck and Schwarz, 2013). Here, Russia's role as a user of foresight studies stands out. In May 12, 2012, the decree of the President of the Russian Federation N596 "On the long-term national economic policy" requested the establishment of a foresight system "oriented towards the meeting of long-range requirements of the manufacturing sector, in the light of the developments in key manufacturing technologies". In 2015, the federal law "On Strategic Planning in the Russian Federation" lifted STI foresight activities to the level of key policy instruments. Today, Russia is among the few countries that has its national TFS established by a federal law. This special issue builds on these developments. The collected papers provide an in-depth insight into recent foresight activities in Russia and present findings and conclusions out of various application fields and technological areas.

Gulnara I. Abdrakhmanova and Oleg V. Ena in their paper "ICT through the prism of critical technologies" analyze trends and prospects of information and communication technologies in

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Russia *vis-à-vis* lists of national critical technologies as approved by the Russian President in 2006 and 2011.

The paper "Russian S&T Foresight 2030: case of nanotechnologies and new materials" by Konstantin Vishnevskiy and Andrei Yaroslavtsev describes key trends for the cross-disciplinary field of new materials and applied nanotechnology and discusses potential implications for the Russian economy.

Liliana Proskuryakova in her paper "Russia's Energy in 2030: future trends and technology priorities" provides an ex-post evaluation of the outcomes of the Russian Science and Technology Foresight 2030 for the energy sector.

Another paper devoted to the energy sector is "Global Energy Challenges and the National Economy: Stress Scenarios for Russia" by Ilya F. Kuzminov, Alexey Bereznoy and Pavel Bakhtin. Their contribution focuses on emerging technologies and their disruptive potential for Russia's oil and gas exports. Four stress scenarios presented describe the current situation, future prospects and major factors that impact Russia's position on the global energy markets.

The paper "Water resources – an analysis of trends, weak signals and wild cards with implications for Russia" by Ozcan Saritas and Liliana Proskuryakova addresses one of the most intensively discussed grand challenges – access to clean water. Key threats and opportunities for different models of water supply and wastewater disposal are discussed with respect to their potential application in Russia.

Ozcan Saritas and Ilya F. Kuzminov in their "Global Challenges and Trends in Agriculture: Impacts on Russia and Possible Strategies for Adaptation" present key results of a foresight study of the agro-industry sector in Russia (based on horizon scanning, text-mining analysis and in-depth interviews) and propose two adaptive strategies of its development that could ensure national food and biosecurity.

In the paper "The evolution of cluster initiatives in Russia: the impacts of policy, life-time, proximity and innovative environment", Evgeniy Kutsenko *et al.* provide an empirical analysis of a set of policy instruments for the development of technology-based innovative regional clusters in Russia.

This special issue provides insights into the foresight practice that often is hard to obtain for the interested readership. It is though also intended to spur further development of foresight and should invite other studies to report on similar experiences out of other countries.

References

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