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FTA supporting effective priority setting in multi-lateral research programme cooperation: The case of EU–Russia S&T cooperation

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ABSTRACT

Common global societal challenges require common answers, also in programming research to help offer those answers. This paper addresses the issue of priority setting for research programming in a multi-layered and multilateral context, taking into account the interests of diverse stakeholder groups. It uses a structured FTA approach to offer guidance for the design of foresight exercises supporting such priority setting, drawing on the case of S&T cooperation between EU Member States, countries associated to the FP7, and Russia. A framework is proposed for thematic priority setting through the application of Future-oriented Technology Analysis (FTA) and for achieving clear policy impacts by including principles for impact optimisation. A combination of foresight methodologies such as expert workshops, a Delphi survey, roadmapping elements, and prioritisation techniques was applied to select relevant topics for a joint research call. The paper shows how foresight can be embedded in a multilateral S&T programme cooperation using a set of coordination dimensions and design principles. Strategies for achieving policy impact and for communicating foresight results are also outlined. Future research is proposed to further improve guidance to facilitate more global research programme cooperation in the future to jointly address global challenges.

1. Introduction

In a context of global challenges, not only the performance but also the programming of research needs to become more global to be effective in addressing those challenges. International cooperation in science and technology (S&T) at the programming stage between different world regions thus becomes increasingly important, but also poses complex challenges with respect to multi-level and multilateral policy coordination. A considerable research body exists with regard to multilevel transnational research programming within a specific world region (OECD, 2003; Kaiser and Prange, 2004; Reid et al., 2007; Könnölä et al., 2011, 2012), but little is known about what this means for cooperation between world regions (one of few examples is described by Gnamus, 2009). This paper addresses the issue of priority setting for research programming in such a multi-layered and multilateral context, taking into account the interests of diverse stakeholder groups. The framework proposed offers guidance for the design of foresight exercises supporting such priority setting, drawing on the case of selecting challenges and research areas for S&T cooperation between the EU, countries associated to the FP7, and Russia in an ERA-NET (European Research Area Network) context. The case builds on the activities of ERA.Net RUS, a project which received considerable policy attention in light of the EU–Russia Year of Science in 2014.[1]

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[1] See http://eu-russia-yearofscience.eu/en/index.php.

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2. S&T priority setting in transnational and international research programme collaboration

2.1. Current knowledge base

2.1.1. Addressing grand challenges in different parts of the world

Today the research programming for addressing grand societal challenges becomes a more urgent issue in the national and international contexts (Boden et al., 2012; Hoareau McGrath et al., 2014). More states are concerned with problems of global warming, an ageing population, terrorist attacks, etc. A natural first step in addressing such challenges is their identification. Over the last century an increasing number of studies have been dedicated to this problem.[2] A decade ago the concept had a rebirth with the Bill & Melinda Gates Foundation defining a list of 14 grand challenges in global health,[3] followed by more specific health initiatives.[4] In recent years the US presented the idea of S&T application for addressing grand challenges for development (U.S. Agency for International Development, 2013) and a set of grand challenges in engineering[5] (prevention of nuclear terror, reverse-engineering of brain, etc.). Generally, over the last decade about 50 individual grand challenges were identified in Canada and the USA in global health, chronic non-communicable disease and engineering.

This list of grand challenges has substantial overlaps with the challenges identified by the EU. The main document in the EU on grand challenges is the Europe2020 strategy, focusing on smart, sustainable and inclusive growth and encompassing 7 flagship initiatives (EC, 2010). The societal challenges are made more concrete in the Horizon 2020 Programme (2014–20), the financial instrument implementing the Innovation Union Flagship Initiative. It is centred on excellent science, competitive industries and a better society, and includes 7 societal challenges.[6] Whereas Horizon 2020 mobilises EU funds, a pooling of national research resources from Member States takes place around 10 societal challenges in the frame of Joint Programming Initiatives.[7]

In the last years the concept of grand challenges has also become more urgent for Russia. A list containing around 140 challenges was established under the Russian S&T Foresight 2030. These challenges were divided into 4 main groups: economic, environmental, social and political, science and technology challenges (Gokhberg, 2013).

This brief review of approaches of different world regions in addressing grand challenges depicts that the problems humanity aims to solve are largely similar. That is why programme cooperation in S&T across borders is useful for addressing such challenges. And such cooperation is not only useful, it is essential, as challenges ahead cannot be solved by single agencies or through national planning approaches alone (Cagnin et al., 2012) and current governance systems are incapable of tackling current and future global interconnected challenges (Boden et al., 2010). This includes not only national systems, also existing governance systems and processes at both European and global levels appear to be no longer sufficient, calling for new models of governance. If S&T research is to contribute to addressing these challenges, new models for cooperation and for setting joint priorities will be required also in organising research programming.

2.1.2. S&T programme cooperation in a multilevel multilateral context

A range of examples exist in collaboration on S&T programming, ranging from bilateral programmes between countries (such as the Swiss Bilateral Programmes with priority countries) and multilateral programmes between nations (such as the Open Research Areas Plus programme[8]), to joint programmes between world regions (such as joint programmes between the US and Russia[9]). Collaborative programmes between the EU and other countries and world regions are considered separately here, due to the largely decentralised nature of public research budgets within the EU. This entails that attempts for international research programming are either multilevel (taking into account European and national/regional level programmes) or are limited in scope by focusing only on one single level. A multilevel collaborative context makes the governance of joint programming more complex. In order to specify what governance in this context entails, Stamm et al. (2012) apply 5 dimensions when considering governance of international STI cooperation: priority setting, funding and spending, knowledge sharing and intellectual property, putting STI into practice, capacity building for research and innovation. In this paper we focus on the priority setting dimension, with a particular focus on a multilevel and multilateral governance context.

2.1.3. Setting joint S&T priorities in research programming and the role of FTA

Several authors recognise the key importance of agenda-setting for science at the global level, taking into account longer-term perspectives and their inherent uncertainties. As argued by Keenan et al. (2012), foresight is an approach that can help addressing these concerns. Cagnin et al. (2012) argue that FTA can offer three types of benefits (informing, structuring and capacity-building benefits) in orienting innovation systems towards grand challenges. Boden et al. (2012) see three challenges for STI policy, when it comes to addressing

[2] The idea of grand challenges was proposed more than a century ago by the famous mathematician Dr. David Hilbert who presented 23 challenges in mathematical foundations, prime numbers, etc. (Weisstein, 2007).

[3] www.gatesfoundation.org.

[4] Examples are the identification of grand challenges for chronic non-communicable disease by the team of Dr. Abdallah Daar, and an initiative in mental health for verification of grand challenges (http://grandchallengesgmh.nimh.nih.gov).

[5] http://www.engineeringchallenges.org/cms/challenges.aspx.

[6] The 7 challenges are: 1. Health, demographic change and wellbeing; 2. European Bioeconomy Challenges (Food security, sustainable agriculture and forestry, marine and maritime and inland water research); 3. Secure, clean and efficient energy; 4. Smart, green and integrated transport; 5. Climate action, resource efficiency and raw materials; 6. Inclusive, innovative and reflective societies; 7. Secure societies.

[7] The 10 Joint Programming Initiatives are: Alzheimer and other Neurodegenerative Diseases; Agriculture, Food Security and Climate Change; A Healthy Diet for a Healthy Life; Cultural Heritage and Global Change: A New Challenge for Europe; Urban Europe — Global Urban Challenges, Joint European Solutions; Connecting Climate Knowledge for Europe; More Years, Better Lives — The Potential and Challenges of Demographic Change; Antimicrobial Resistance — The Microbial Challenge — An Emerging Threat to Human Health; Water Challenges for a Changing World; Healthy and Productive Seas and Oceans.

[8] International research programme between national funding agencies of France, Germany, the UK, the Netherlands and the US, with a focus on social sciences.

[9] E.g. the US–Russia Bilateral Collaborative Research Partnerships (CRP) on the Prevention and Treatment of HIV/AIDS and Co-morbidities.

Table 1
Tensions in setting joint S&T priorities in international S&T cooperation.Based on Brummer et al., 2009; Dalrymple, 2006; European Commission, 2009; OECD, 2011; Stamm and Figueroa, 2012.

Tensions in setting joint S&T priorities	Description
Thematic versus structural priorities	Will the priorities focus on thematic or structural S&T issues?
User-based, institutional or political	Is the selection of priorities mainly driven by users' needs, by researchers, or by broader policy choices?
Specialisation versus diversification	Diversification allows for several different priorities while specialisation focuses on specific interrelated ones
Narrow versus broad priorities	Broad definition of priorities ensures more legitimacy and support from all partners but makes implementation into actions more difficult
Choice of the targeted stage of the STI process	Will the focus be on basic research, on applied research, on innovation?
Supply-led versus demand-led	From which perspective are the priorities formulated?
Short term versus long term	Is the focus a strategic long-term cooperation agenda or rather topics for a short-term joint call?
Low versus high available budgets	The size of budget will also impact on other tensions (e.g., broad versus narrow)
Bottom-up versus top-down	Is the focus on 'lower-level' actors identifying motives and rationales for international co-operation and trying to persuade 'higher-level' actors? Or rather on 'high-level' policymakers taking international cooperation as a policy imperative and ensuring that it becomes an integral part of their S&T policy implementation strategies?
Focus on existing capacities versus building new ones	Capacities can refer to knowledge, networks, (human) resources, infrastructure, etc.
New themes vs. validation of existing ones	New themes may build on existing capacities or on new ones
Variable geometry versus consensus	Variable geometry seems to favour the most influential members while a consensual approach seems to favour smaller members
Technology-oriented versus challenge-oriented	From which perspective are the priorities formulated?

grand challenges and the role of FTA: experiment more with horizontal mechanisms, focus more on disruptive changes and take more advantage of processes using crowd-sourcing. An example of the latter is the approach developed by Brummer et al. (2011) for both identifying priorities and for shaping collaborative networks through which the resulting priorities are implemented. Other examples of cooperation focus on developing more suitable anticipatory methodologies for future trends and needs in support of identifying or refining priorities (such as the cooperative foresight project between NISTEP in Japan and Tekes in Finland (Syrjänen et al., 2009)). Examples of pan-European priority setting using foresight include KORANET[10] (applying foresight for the identification of cooperation areas of common interest for future funding collaboration between Korea and the European Union), and the FP7 project Synchroniser,[11] focusing on EU–India cooperation in research funding. In the latter project long-term joint research paths were identified using a 3 round Delphi survey among 30 visionary experts, including personal interviews with each expert, as well as an assessment by Venture Capital stakeholders of the priorities identified (round three of the Delphi). Another approach concerns the Standing Committee on Agricultural Research (SCAR), which has a longstanding experience in applying anticipatory approaches for identifying priority areas of collaboration (SCAR, 2014). These have led to the creation of two Joint Programming Initiatives ("Agriculture, Food Security and Climate Change" and "A Healthy Diet for a Healthy Life") and several other Joint Programming Initiatives are currently also planning to implement large-scale anticipatory approaches in support of their joint programming activities (such as JPI Urban Europe and JPI Oceans). Finally, Cagnin and Könnölä (2014) propose principles for the design and management of global foresight exercises building on typical characteristics (such as geographical dispersion, organisational and cultural differences, and the diversity arising from a large number of participants) of such exercises.[12]

Reflecting this wide set of practices, literature on the use of FTA for joint S&T priority setting has also advanced in recent years. Many authors recognise the existence of tensions and the need for finding a balance between those tensions in setting research priorities (Brummer et al., 2009; Dalrymple, 2006; European Commission, 2009; OECD, 2011; Stamm and Figueroa, 2012). An overview of such tensions identified in recent literature is presented in Table 1.

It should be noted that each of those tensions can be seen as a continuum on which many options are possible. For instance, Stamm and Figueroa (2012) argue that it can be useful to develop a structure that allows for both bottom-up and top-down approaches in order to maximise inclusion without leading to inefficiency in the prioritisation process. Tensions are obviously also interrelated, e.g., low budgets may require more narrow priorities than wider budgets. In this collaborative context characterised by multidisciplinary societal challenges and many variables to decide upon for collaboration, the paper looks at the following topic.

2.2. Focus of the paper

The paper aims to advance the existing knowledge base on models for organising collaboration across borders in research programming for addressing multifaceted and interconnected societal challenges taking into account the interests of diverse stakeholder groups, with a specific focus on thematic priority setting. More concretely it aims to offer guidance in the process of selecting joint thematic priorities in a multi-layered and multilateral programming context. A framework is proposed for thematic priority setting through the application of Future-oriented Technology Analysis (FTA) and for achieving clear

[10] www.koranet.eu.
[11] http://www.synchroniser.org/docs/Perspective_Action_Plan.pdf.

[12] The principles are: understanding interconnected innovation systems; responsiveness towards diverse languages and cultures; capacity to reconfigure international networks; and 'glocal' impact orientation.

Table 2
Framework for structuring large-scale foresight exercises in support of multilateral, multilevel research programming focusing on multifaceted societal challenges.Adapted from Könnölä and Haegeman, 2012.

Coordination dimension	Description
Systemic coordination	Alignment of structural and systemic differences in national research systems
Vertical coordination	Coordination between local, regional and (inter-) national levels
Horizontal coordination	Coordination between research, innovation and other policy areas (such as competition, regional, financial, employment and education policies)
Temporal coordination	Ensuring that policies continue to be effective over time and that short-term decisions do not contradict longer-term commitments ('dynamic efficiency')
Multilateral coordination	Coordination between two or more non-hierarchically structured policy levels
Foresight principle	**Description**
Scalability	Ability to process contributions vertically from stakeholders who are accustomed to different levels of abstraction when considering regional, sectorial, national or European priorities
Input scalability	Makes it possible to involve varying amounts of contributions from a changing number of stakeholders.
Geographical scalability	Makes it possible to involve stakeholders regardless of the geographical distance between them
Administrative scalability	Permits the decomposition of the foresight process into manageable sub-processes and enables transitions between different levels of abstraction by way of problem structuring and synthesis (Könnölä et al., 2011).
Modularity	Process design where analogous sub-processes – or modules – can be enacted relatively independently from the other sub-processes (Könnölä et al., 2011).
Flexibility	Flexibility in the design and management of the foresight process in order to accommodate different national interests, capabilities and culture in transnational programming.

policy impacts (see Johnston and Cagnin, 2011) by including principles for impact optimisation. We use the case of an ERA-NET project supported under the EU's FP7 programme, the ERA.Net RUS,[13] which aims at coordinating R&D and innovation policies and support programmes between EU Member States, countries associated to the FP7 and Russia. A combination of foresight methodologies such as expert workshops, a Delphi survey, roadmapping elements, and prioritisation techniques were applied to select relevant topics for a research call. The paper shows how foresight can be embedded in a multilateral S&T programme cooperation using a set of coordination dimensions and design principles. Strategies for achieving policy impact and for communicating foresight results are also outlined.

2.3. Methodology

An existing framework for large-scale transnational foresight exercises (Könnölä and Haegeman, 2012) proposes 4 coordination dimensions (horizontal, vertical, temporal and systemic coordination) and 3 foresight principles (scalability, modularity and flexibility) related to such foresight endeavours, which are explained in Table 2. To this framework the multilateral aspect is added by including a fifth coordination dimension: 'Multi-lateral coordination' can be defined as coordination between two or more non-hierarchically structured geographical areas. It can concern coordination between two or more nations, two or more world regions, between a world region and one or more countries, etc. The main difference with the vertical coordination is the absence of a hierarchical relationship between the geographical areas.

The dimensions and foresight principles from Table 2 together with the tensions of Table 1 are used for analysing how the foresight project in support of EU–Russian priority setting has offered a guiding process for selecting joint thematic priorities that takes into account the (stakeholders and aspects of) different coordination dimensions that are typical to collaborative programming (see Tables 6 and 7), and that makes the multiple aspects of priority setting explicit (and therefore more transparent) (see Table 5). In addition, from the case a focus group methodology is derived for building consensus on priorities in a context of varying and sometimes conflicting interests (Fig. 4). Finally, foresight design principles are identified that support policy impact at different S&T governance levels (Section 4.1), and to balance out bottom-up versus top-down prioritisation.[14] The four above described elements constitute a framework for setting joint thematic priorities in transnational research programme cooperation in a multilateral cooperation setting.

3. The case: S&T cooperation between the EU, its Member States, Associated Countries and Russia

3.1. Case description

Science and Technology (S&T) and Innovation cooperation between the EU, its Member States (MS), Countries Associated (AC) to the EU's 7th Framework Programme for RTD (FP7), and Russia is developing dynamically at both multilateral and bilateral levels. Bilateral calls between Russian funding agencies (e.g., Russian Foundation for Basic Research — RFBR, FASIE) and funding agencies from the EU MS/AC countries (e.g., German Research Foundation — DFG, etc.) have been impressive both in terms of the number of projects co-funded and the total amount of financial support provided in the scope of these bilateral projects.[15] Bilateral programmes were successfully coordinated and lifted to the multilateral stage in the ERA.Net RUS, which managed to pool resources of funding agencies

[13] See for details of this project: http://www.eranet-rus.eu/.

[14] An example of top down prioritisation is the use of the societal challenges defined as part of Horizon 2020 as a basis for the roadmaps and the thematic part of the Delphi questionnaire. An example of bottom-up prioritisation is the participatory way in which possible priorities were discussed in the thematic focus groups and the voting procedures to reach a final decision (see Fig. 4).

[15] See ERA.Net RUS analytical report 3: State of the art and perspectives of bilateral S&T programmes between EU MS/AC and Russia, http://www.eranet-rus.eu/_media/D_1.3_Analytical_Report_3.pdf.

Table 3
Project description of the ERA-NET.RUS project and the ERA-NET.RUS PLUS project (DoW ERA—NET.RUS, 2008; DoW ERA-NET.RUS PLUS, 2013).

Title	ERA-NET.RUS	ERA-NET.RUS PLUS
Partners	18 partners from 7 EU Member States, 2 Associated Countries, Russia (4 partners) and the European Commission (JRC-IPTS).	24 partners from 9 EU Member States, 4 Associated Countries and Russia (8 partners).
Timing	02/2009–01/2014	11/2013–11/2018
Goal	Develop options and scenarios for the coordination of joint S&T programmes of funding institutions in EU-Member States (MS) and Associated Countries (AC) with Russian programme owners; implement a pilot joint call; evaluate the call and propose a concept for a sustainable joint programme	Launch, implement and monitor a Single Joint Call for R&D and innovation projects among funding institutions in EU-Member States (MS) and Associated Countries (AC) with Russian programme owners. Follow-up and monitor the implementation of the ERA.Net RUS Action Plan.
Project principles	• Focus on governmental programmes (bilateral agreements), while considering non-governmental activities as well • Acknowledging the multilateral environment of EU–Russia relations • Keeping openness to additional programme owners outside the consortium to join the Pilot Joint Call • Cooperation with Russian programme owners on equal footing targeting joint interest in the phase of planning and implementing a pilot joint call • Exploiting synergies with other coordination activities	
Role of foresight	Conduct both a structural and a thematic foresight in support of developing a sustainable S&T cooperation between EU MS, AC and Russia with a concrete vision paper and action plan up to 2020	Follow-up of ERA.Net RUS foresight results, monitoring of the implementation of the action plan and of the ERA.Net RUS Plus call (based on thematic foresight input), and assessing the impact of cooperation in the ERA-NET frame.

from 11 EU MS/AC, and from Russia. Two pilot joint calls were implemented, one for funding of 'Collaborative S&T Projects', and one for 'Innovation Projects'. With a total budget of €10.3 million a total number of 42 joint projects were funded under the two calls. The EU's Framework Programme for RTD (FP) (and as of 2014 Horizon 2020) is its primary scheme for international (multilateral and multilevel) cooperation that the Russian research institutes and individual researchers can take part in. Russia has been consistently the most successful third country participant[16] in the FP6 (2002–2006) and the FP7 (2007–2013). The country ranked first in terms of funding received in FP projects and in the number of participants in the funded projects, and therefore ahead of other third countries such as the USA, or the other BRICS. There have been 463 Russian participants in 291 signed grant agreements, receiving an EU contribution of € 63 million with status December 2012.[17]

In this collaborative context and in the frame of the EU-FP7 funded ERA.Net RUS project, a foresight exercise has been implemented which has fed into a vision paper and action plan for future S&T cooperation (Spiesberger et al., 2013a, 2013b). Thematic foresight results also support the priority setting for the thematic joint call under the ERA.Net RUS Plus project, which has started in November 2013. This paper will look at the foresight processes used in relation to the experiences from ERA.Net RUS, and how this connects to the follow-up project ERA.Net RUS Plus. Both projects are briefly described in Table 3.

3.2. Foresight processes

3.2.1. Overview

As summarised in Table 3, the ERA.Net RUS project included both a structural and a thematic foresight. The structural foresight refers to institutional solutions and instruments (e.g., funding programmes) for the cooperation, whereas the thematic foresight refers to relevant thematic priorities for the cooperation. The foresight and the resulting scenarios have provided a basis for suggesting measures for improving the RDI cooperation and for developing a sustainable joint funding programme between EU MS/AC and Russia. These measures and possible programmes have been outlined and published in an ERA.Net RUS Vision Paper and an Action Plan for implementation up to 2020 (Spiesberger et al., 2013a, 2013b). The final vision paper and action plan was presented at the kick-off meeting of the ERA.Net RUS Plus project in November 2013 for approval of the Group of Funding Parties.

Herewith the suggested vision and action plan received the backing of the Group of Funding Parties, and the topics selected in the foresight were formally approved for the ERA.Net RUS Plus call for research projects which was opened shortly afterwards. Both parts of the foresight process ran in parallel and were interlinked, as presented in Fig. 1. This approach was used, because a focus on promising thematic priorities for the cooperation was needed for advancing the RDI cooperation overall (the structural side). Furthermore, involvement in both parts of the foresight created commitment among the main stakeholders involved, the funding organisations, and helped optimise resources.

In this paper we focus on the thematic component of the foresight process. In support of thematic S&T priority setting for EU–Russia collaboration a set of existing foresight methodologies (Delphi surveys, roadmapping, etc.) have been adapted, combined and complemented by novel synthesis and prioritisation techniques in a set of thematic expert workshops in order to select societal challenges and research areas relevant for Russia, the EU and its Member States and Associated Countries to the FP7 involved in the ERA-NET call for research projects (in support of the ERA.Net RUS Plus call launched in 2014).

3.2.2. Thematic foresight

Analytical support for the funding activities within ERA.Net RUS and the ERA.Net RUS Plus through studies on the state of EU–Russian S&T cooperation and the foresight exercise has provided an important input for an informed and transparent priority setting. Experience from the ERA.Net RUS Pilot Joint Call in 2011 has shown that the issue of defining the thematic scope of the call is highly relevant for the involved RDI funding organisations; this issue cannot quickly be solved and may lead

[16] Third Country means here a country, which is not an EU Member State or a country associated to the FP.
[17] Spiesberger et al., 2013a. Russian participation in FP7. http://issek.hse.ru/news/79027067.html.

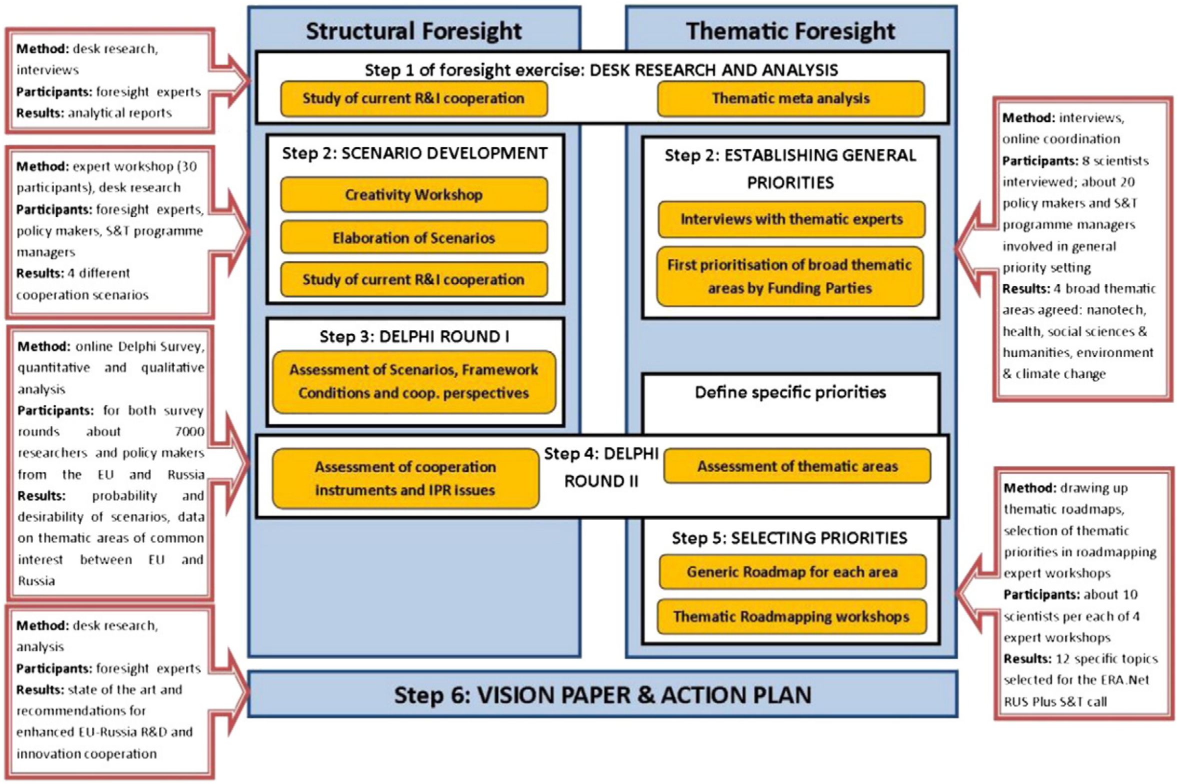

Fig. 1. Structural and thematic foresight process of the ERA.NET. RUS project.

to conflicts and questioning of the whole call by funding organisations and researchers participating in the call, if not properly done. In the Pilot Call topics were proposed and selected by representatives of the funding organisations in the frame of a coordination meeting, and then fine-tuned later on in an e-mail coordination process among the involved partners. As opposed to this ad-hoc approach, the topic identification for the next calls was supported by a thematic foresight in which researchers from the EU and Russia selected in a well-prepared, structured and consensual process the call topics, as described in Fig. 1.

3.2.2.1. 4 General priorities. Based on experience from bilateral cooperation, and considering a meta-analysis of thematic foresights at national level (Germany, France, etc.) and a set of interviews with thematic experts experienced in EU–Russia collaboration,[18] the funding parties of the ERA.Net RUS Plus call decided in a voting procedure among their representatives on a first prioritisation in 4 broad thematic areas: nanotech, health, social sciences and humanities, and environment and climate change.

3.2.2.2. Thematic Delphi. Based on those broad areas, the thematic part of the Delphi survey was designed, combining two data sources, societal challenges formulated by the EU and Russian research areas:

1. For the societal challenges, the nomenclature proposed as part of the draft Horizon 2020 proposal of the European Union was used, up to the most detailed level available in the nomenclature: 6 societal challenges (at the time of the proposal, later on between the Delphi and the workshop the number has changed into 7 challenges) with each up to 2 sublevels.
2. For the research areas a Russian nomenclature was used for each of the 4 thematic areas, with each up to 2 sublevels, drawing on the basis of the Russian S&T Foresight 2030 implemented by Higher School of Economics in 2011–2013 (Gokhberg, 2013). The thematic Delphi allowed identifying promising research areas at different levels of detail (see example in Fig. 2). An overall sample of 6695 experts (4408 from EU MS/AC and 2287 from Russia) was contacted to fill in both Delphi rounds. Participation in the survey was by invitation only. The sample of invited experts was compiled from the following sources: scientists from EU MS/AC and Russia, who co-publish (taken from the Web of Science for the reference year 2010), researchers involved in the ERA.Net RUS Pilot calls for S&T and innovation projects, and representatives from the European Commission and funding organisations from the EU MS/AC and Russia. The survey questionnaire was developed in two language versions, in Russian and English languages, but with the same questions. The overall response rate to the second (thematic) Delphi round was around 15% (13% for EU MS/AC and 18% for Russia).

3.2.2.3. Generic roadmaps. Generic roadmaps for each thematic area were constructed using the same data sources as for the thematic Delphi, connecting in one single roadmap per area

[18] Interviewees were experts in thematic fields where Russia has significant research potential such as nanotechnologies, new materials, and health.

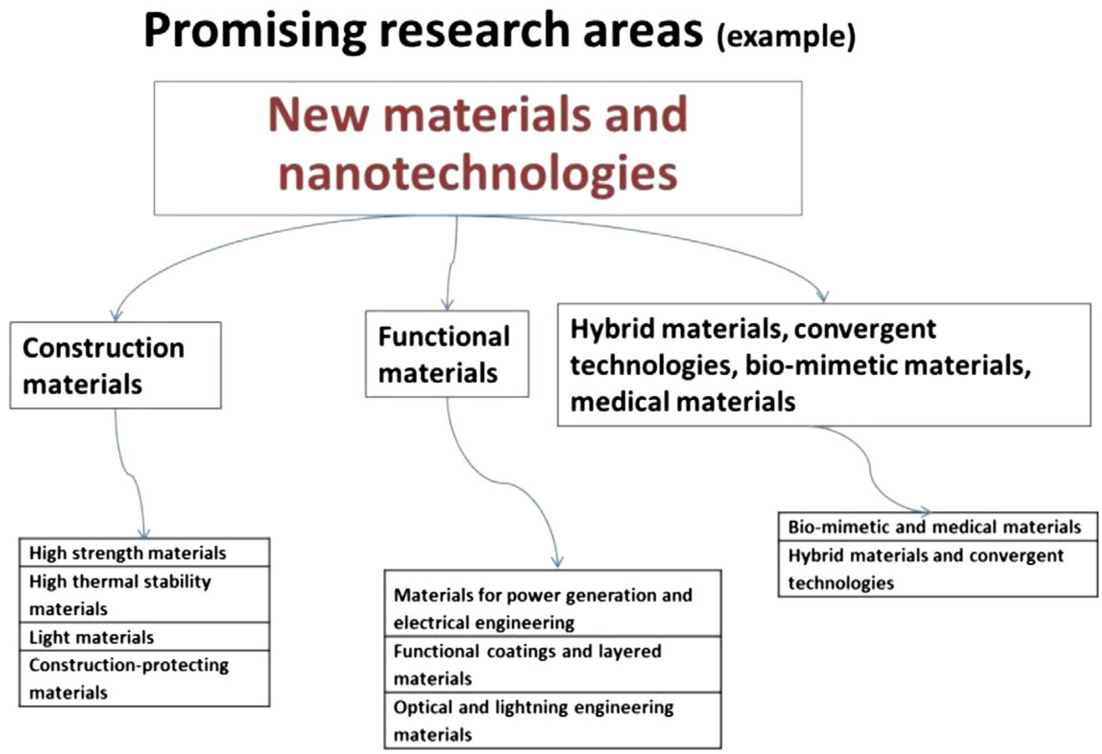

Fig. 2. Promising research areas at different levels of granularity according to Delphi respondents.

societal challenges to research areas. In the initial roadmaps that were developed, a high level of detail was included, but this appeared to be less useful for the workshop discussions. Fig. 3 illustrates the roadmap for nanotechnologies, which was discussed in one of a series of four workshops.

3.2.2.4. Thematic roadmapping workshops. Scientific experts were nominated by each funding organisation planning to participate in the ERA.Net RUS Plus call (with status Spring 2013). Per each workshop between 9 and 12 experts participated; experience showed that a setting of 10 experts and less was most productive for the outcome of the workshop. A higher number of participants makes the discussion more cumbersome as more opinions need to be coordinated, and furthermore the time setting of a limit of 6 h per workshop was endangered. Preparatory documents including all thematic results were compiled by the foresight partners and shared with participants one week before each workshop. The workshops were moderated by foresight experts aiming to play the role of neutral brokers of topics, and not by technical experts. European Commission representatives from thematic and international directorates of Directorate General for Research and Innovation were involved and participated in the workshops, to enhance the coordination regarding thematics between the ERA-NET project and Horizon 2020. The workshops followed a four step approach (Fig. 4). Each workshop lasted for approximately six hours, and included an informal dinner the evening beforehand in order for participants to get to know each other.

3.2.3. Thematic foresight results

The tangible outcomes of the four thematic workshops include the following elements:

- Identification of three topics for each broad thematic field for the joint call under the ERA.Net RUS Plus project (see Table 4)
- Additional topics for future S&T collaboration (see Table 4)
- A detailed description for each of the above (example: see Fig. 5)

Table 4 presents an overview of all topics identified at the thematic roadmapping workshops for each thematic area.

The workshops provided an interesting experience in supporting priority setting in a multi-level (European/transnational, national) and multilateral (MSs, ACs, Russia) policy context. S&T programming collaboration in such a multi-layered context is complex and poses many challenges in aligning interests of diverse stakeholders. A recurring aspect in all thematic workshops was related to intangible impacts. The feedback from workshop participants on the experience of participating in a meeting with counterparts from other countries and discussing and deciding jointly on priority areas was perceived as very rewarding and for some participants it was a novel experience.

3.3. Application of the framework

3.3.1. Effects of priority setting tensions on the foresight design

In Table 5 the tensions described in Section 2 are applied to the ERA.Net RUS case. The choices made for each of the tensions have had an impact on the foresight design. Not all choices

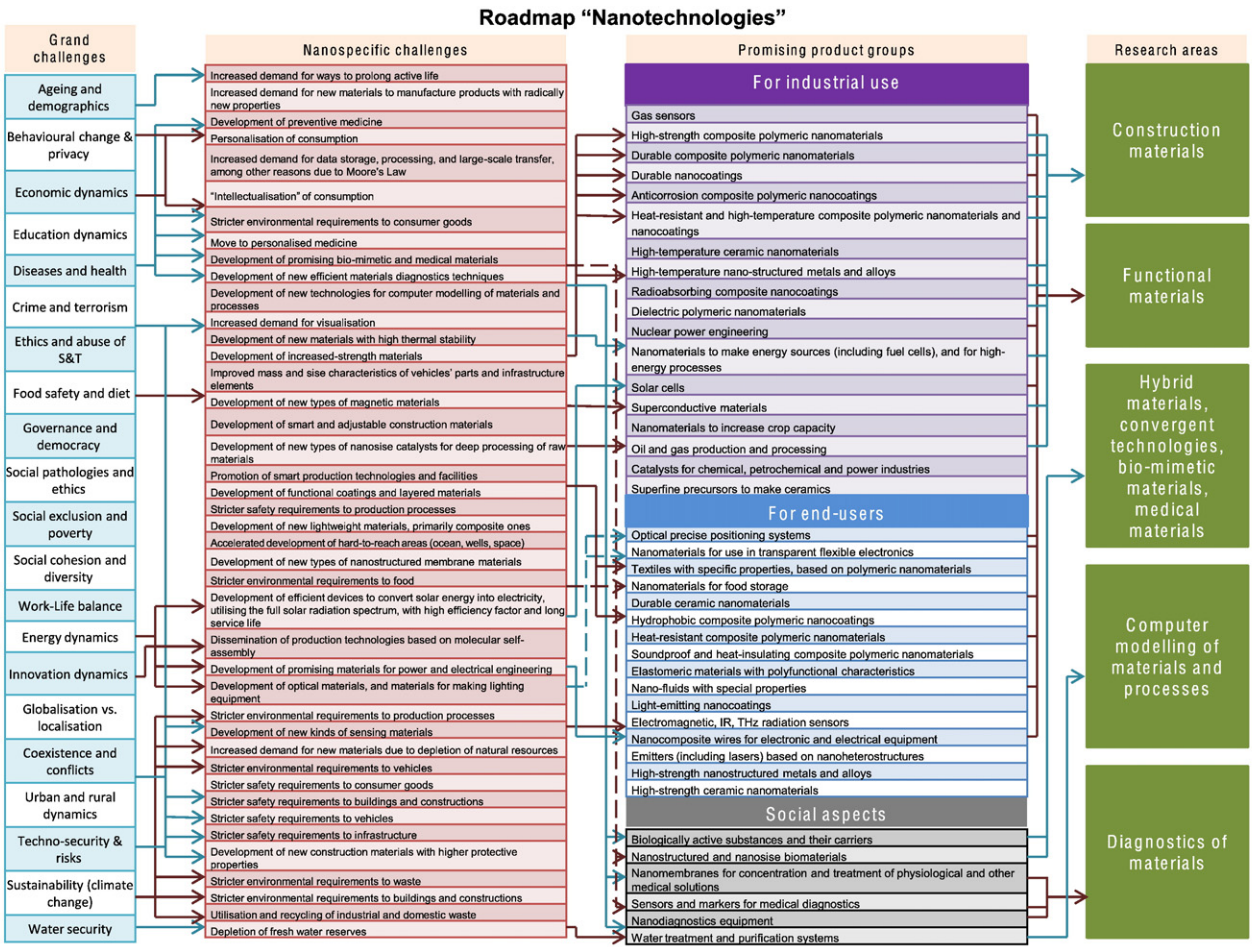

Fig. 3. Generic nanotechnologies roadmap linking societal challenges to research areas.

were however made ex-ante in an explicit way (only the choices in *italic* in Table 5 were to a great extent decided upon ex-ante), but rather 'en cours de route' or only implicitly when looking at the final results (ex-post). The foresight design is thus affected in different ways by the way decisions are taken with regard to each of the tensions, indicating the need for flexibility in design and management of the foresight process, especially when a large part of the decisions is not clear from the start. Reasons for lack of clear decisions may be disagreement among partners, the desire to keep some degree of freedom in fixing the design and management of the exercise (see e.g., Salo et al. (2009) who distinguish between fixed and autonomous management of foresight), or just because the tensions were not considered at the start of the foresight project.

3.3.2. Assessing the ERA.Net RUS case against dimensions of coordination

In Section 2 five dimensions for the design, management and implementation of a large-scale foresight exercise were introduced along which coordination is needed in order to optimise S&T programme cooperation in a multilateral multi-level context. Table 6 presents how each of those dimensions is reflected in the design, management and implementation of the foresight exercise. The foresight exercise for the case was not designed using this particular framework, so obviously each of the dimensions is only partially reflected in the case. Therefore Table 6 also provides an ex-post assessment of possible additional elements that could have been integrated in the foresight exercise, in case this framework had been used as a basis from the start.

The need for systemic coordination between national research systems in international cooperation is reflected in the foresight design of ERA.Net RUS e.g., by including questions on current and future state of national research systems and how this affects future cooperation. Fig. 6 presents barriers to increased EU–Russia S&T cooperation, which largely relate to the effectiveness of the respective national systems. In fact the whole structural part of the foresight exercise including the cooperation scenarios has connections with systemic coordination (see also Fig. 1).

Vertical coordination is reflected e.g., through involvement of both EU level experts and national experts in the thematic roadmapping workshops, and by combining EU level priorities on societal challenges from Horizon 2020 as a basis for national level priority setting for S&T cooperation. The latter also relates to horizontal coordination, as societal challenges are by nature multidisciplinary. Temporal coordination is reflected for instance

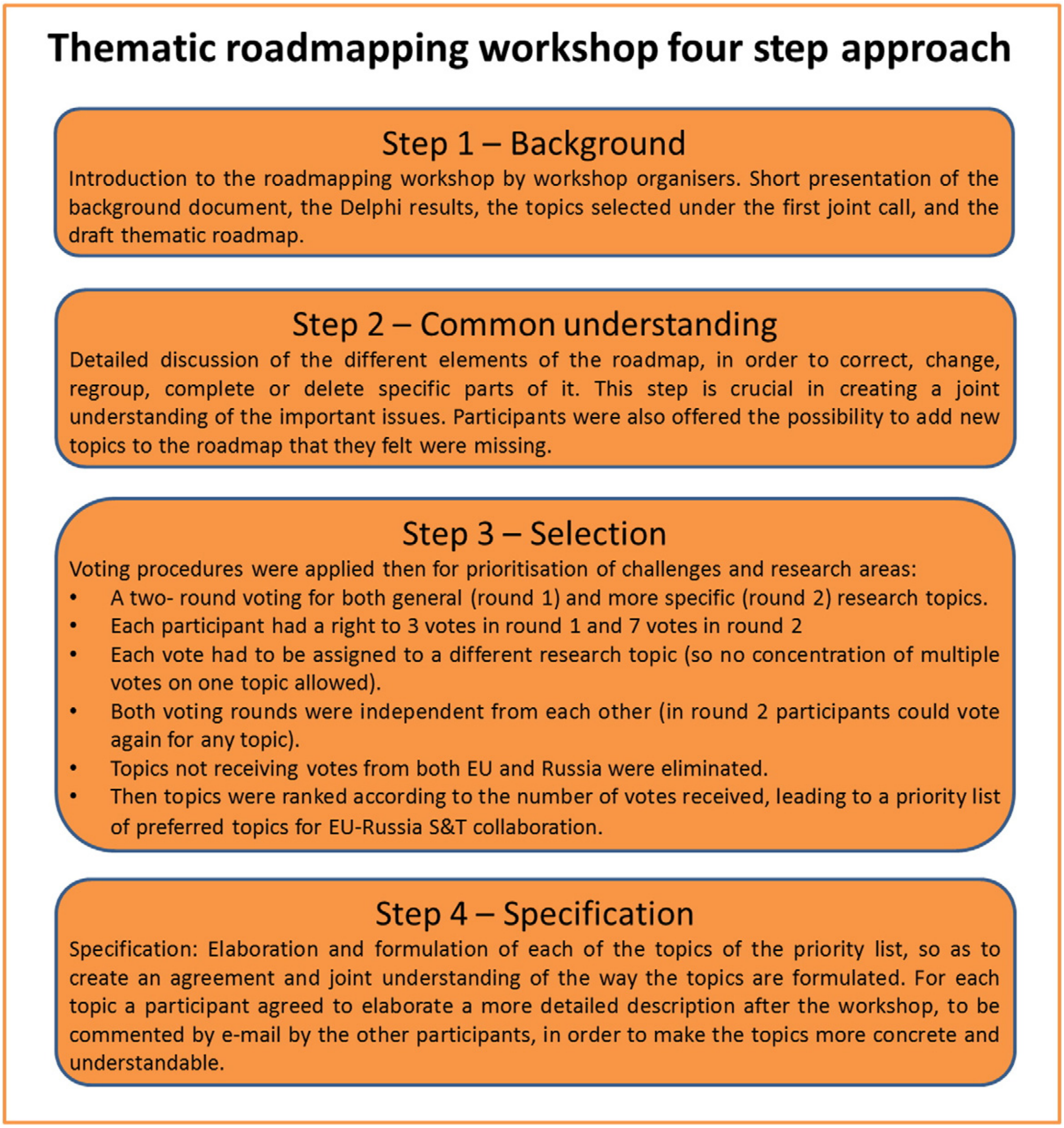

Fig. 4. Four step approach of a 6 h thematic roadmapping workshop.

in the mix of short, medium and long term issues addressed in the structural and thematic foresight. Examples of multilateral coordination are the bilingual Delphi questionnaires and the issue of semantic differences (e.g., inclusive society received low priority from the Russian respondents, but workshop discussions revealed that this terminology is not common in Russia which is likely to have affected the results).

3.3.3. Application of foresight design principles to the ERA.Net Rus case

The three foresight principles for large-scale foresights, as introduced in Section 2, are here applied to the case of ERA.Net RUS (Table 7). The principles serve to structure the involvement of large numbers of stakeholders, to guide selection of priorities in complex environments and to offer an impartial approach to finding solutions for sometimes conflicting interests. Examples of scalability in ERA.Net RUS are many, such as the different levels of abstraction used both for the research areas and for the nomenclature of societal challenges, and the freedom for Delphi respondents to vote at the level(s) they found most appropriate (voting at different levels of abstraction at the same time was allowed for). Also the two round voting (one for general research topics and one for specific ones) is an example of scalability. Combining a structural and a thematic foresight process that run both in parallel with periodic interconnections is one way how modularity was introduced in the project. During the thematic workshops, a high degree of flexibility was needed, in

Table 4
Topics for S&T cooperation between EU MSs/ACs and Russia by thematic area.

Topics for S&T cooperation between EU MSs/ACs and Russia by thematic area			
Health	Nano	SSH	Environment and climate change
Three topics selected for the joint call of ERA.Net RUS Plus			
1. Molecular Mechanisms of Brain Function and Pathology 2. Regenerative Medicine and Biomaterials 3. Drug Discovery for Cancer, Cardiovascular and Infectious Diseases	1. Advanced nano-sensors for Environment and Health 2. Novel functional nanomaterials based on design and modelling 3. Nanomaterials for efficient lighting	1. Understanding Conflict, Identity, and Memory: Past and Present 2. Demographic Change, Migration and Migrants 3. Opportunities for and Challenges to Regional Development and Social Cohesion	1. Increasing the reliability of regional climate projections: models and measurement 2. Environmental impact and risk of raw materials extraction and transportation 3. Extreme climate events and their impact on the environment
Additional topics for future S&T collaboration			
4. Translational Medicine 5. 3D Medicine, Virtual Surgery	3. Solar Cells: Nano-photonics for energy conversion 4. Diagnostics: Metrology at the Nanoscale 5. Nano-sized catalysts 6. Nanomaterials and technologies for memory devices 7. Interdisciplinary of nanotechnologies	4. Understanding conflict and security issues 5. The relevance of archives for SSH research	3. Climate impact on ecosystems (fisheries, land based agriculture) 4. Prevention and remediation of pollution of aquatic systems 5. Climate and pollution in big cities 6. Impact of transport/traffic on climate change and pollution

particular because there was a lack of explicit decisions beforehand on the shape the outcomes would take (see also Table 2 about tensions in priority setting). This required workshop moderators to be particularly open to changes in the way the foresight process was planned for. By the end of the fourth and last workshop, the process was rather consolidated, and consisted of the four steps as presented in Fig. 4.

4. Discussion

Tables 1 and 2 as well as Fig. 4 together offer a general framework for structuring a thematic foresight exercise, which are applied to the case in Tables 5, 6 and 7 and in Figs. 3 and 5. The proposed framework can be used both as an assessment tool of past large-scale foresight exercises (for an illustration, see last column of Table 6 'What could have been done differently, if the framework had been used?'), or as a tool for the design, management and implementation of new ones. In the first case, applying the tool can show policy-makers and other users of the foresight results whether those results are based on a structured approach taking into account the complexity of multilevel multilateral programming, or not. Showing that foresight results are based on a solid structured approach may increase trust in the foresight outcomes, which may in turn increase policy impact of the foresight exercise. Below the framework is complemented by some lessons from the case with regard to such policy impact and the communication of foresight results. Also policy implications and suggestions for further research related to the framework proposed are addressed.

Nanotech Topic 1
Advanced nano-sensors for Environment and Health

Recent progress and advancements in the synthesis of nano-scale materials and coatings have paved the way for the development of innovative and high-performance sensor architectures. The desired properties of such nano-sensor devices include ease of fabrication and integration, compactness, high sensitivity, short response time, reliability and re-usability. In order to achieve the maximum sensor performance, sensing mechanisms (optical, chemical, electrical, mechanical, magnetic, etc.) should be understood clearly. Besides nano-scale materials synthesis, sensor design, sensor fabrication process and recipe development, sensor performance testing is as critical as well for optimum device performance. Environment and health are two major fields in which sensor technologies are heavily used.

The aim of this topic is to pursue research and development (R&D) activities between European and Russian research institutions to promote a strong cooperative interaction, based on KET - Key enabling technologies (nanotechnologies, ICT, advanced materials, etc.) and on the use of top-down and/or bottom-up micro/nano-fabrication processes for advanced and innovative nano-scale sensor structures primarily for environmental and health applications. Sensing mechanisms to be explored might include but are not limited to optical, electrical, chemical, mechanical, and magnetic detection.

Fig. 5. Description of a nanotech topic identified as a priority for EU–Russia S&T collaboration.

Table 5
Implications of priority setting tensions for the foresight design in ERA.Net RUS.

Tensions in setting joint research priorities	Application to the ERA.Net RUS case	Implications for foresight design
Thematic versus structural priorities	*Priorities focus both on thematic areas and structural issues*	Parallel foresight process with a thematic and a structural part and with three milestones for integrating results (see horizontal sections in Fig. 1)
User-based, institutional or political	*Combination of institutional and user-based at the start. Political validation through vision paper*	Limited (workshops) and wider (Delphi rounds) participation moments are combined. Users concern mainly researchers' views.
Specialisation versus diversification	Aiming to strike a balance	Diversification between different call topics was sought; high degree of specialisation was sought for each individual topic. Topics with only one or a few potentially interested research organisations were eliminated.
Narrow versus broad priorities	*Narrow topics were aimed at*	Topics of earlier call were too broad, generating too many proposals. Thematic workshops identified more topics than only for the next joint call. Topics were however rather narrow to feed optimally into Horizon 2020 priorities (difficult to serve different purposes).
Choice of the targeted stage of the STI process	Aiming to strike a balance	Within each thematic area both basic and applied subtopics were selected
Supply-led versus demand-led	Wider topic selection rather supply-led, specific topic selection more demand-led	Wider topics selected by funding parties, specific topics more user-driven and based on societal challenges
Short term versus long term	Structural priorities both long-term and short-term. Thematic priorities short-term and medium-term.	In thematic workshop discussions long-term topics were eliminated — focus on short and mid-term topics In the vision paper one long term thematic topic was included (thematic joint research institute)
Low versus high available budgets	Focus on low budgets	Elaboration and formulation of sufficiently narrow topics, which can be tackled with research projects of low to mid-size research budgets
Bottom-up versus top-down	*Aiming to strike a balance (avoiding the ad-hoc approach applied to the earlier call topic selection)*	Structured foresight process combining top-down and bottom-up
Focus on existing capacities versus building new ones	Thematic focus on existing capacities, structural foresight also on building new ones	Topics without a clear existing research base were eliminated from the list of possible topics in the thematic workshops
New themes vs. validation of existing ones	Wider topics focus on existing ones, specific topics aim to complement existing programmes	Discussions and votings in the thematic workshops reflected the importance of selecting novel subtopics
Variable geometry versus consensus	Mainly focus on consensus	Two voting rounds per thematic workshop reflect variable geometry, but discussions on joint understanding of potential topics beforehand, and engagement of all participants in topic formulation after voting ensured a feeling of involvement and joint decision-making
Technology-oriented versus challenge-oriented	*Combination, both in wider priority areas and in specific ones*	Delphi, roadmaps and workshops included both societal challenges and technologies/research areas.

4.1. Policy impact and communication

With regard to foresight design and policy impact the following considerations can be made:

- *A structured and balanced approach*: A solid and structured foresight approach can help in ensuring policy impact as it communicates to policy makers and decision takers that results have been obtained by using a clear predefined process which shows that stakeholders along different dimensions are involved (see Table 2), in which multiple dimensions of thematic priority setting are made explicit (Table 1), and which offers a structured solution to jointly select few priorities (Fig. 4) in complex domains where the number of possible choices is huge and interests are varying and sometimes conflicting. Even before the foresight exercise was finished, the ERA.Net RUS project and in particular the foresight elements were considered by various European Commission officials to constitute an interesting and ground-breaking case to further advance the understanding of research programming in such a complex landscape, mainly because of the structured approach proposed.
- *Early policy involvement, transparency and ownership*: An early involvement of policy makers and decision takers as well as ensuring transparency and providing sufficient information in a structured way proved a useful strategy to raise sufficient awareness for the foresight exercise. In an early phase of the exercise, representatives of most of the funding organisations participated in scenario validation workshops for structural scenarios and could be made aware of thematic foresight issues already at this stage (in 2011). These representatives were then included in the two Delphi survey rounds implemented in 2012 and 2013, whereby in particular the second round was focused on thematic issues. Regular meetings of the ERA.Net RUS project, such as annual steering board meetings, were used to update the policy makers on advancement with the foresight, including on its thematic component. In preparation of thematic roadmapping workshops implemented in spring 2013, ownership of the thematic foresight was created in that the participating scientific experts were selected and nominated by the representatives of the funding organisations.
- *Good access to experts*: Good access to knowledgeable stakeholders further supports the implementation of a

Table 6
Assessing the ERA.Net RUS case against 5 dimensions of coordination.

Coordination dimension	Elements in the foresight in the ERA.Net RUS case reflecting each dimension	Ex-post assessment of foresight exercise regarding each dimension
Systemic coordination	• Mapping of the current national R&I systems and their differences, current thematic priorities, etc. • Structural foresight including elements related to (current and future) national R&I systems and how this affects cooperation (SWOT analysis includes the national R&I systems; questions in Delphi include national obstacles and framework conditions for cooperation; scenarios include evolution in national R&I systems and their effect on cooperation)	• Differences in systemic issues at national level between EU Member States and Associated Countries could be included • Regional level systemic issues not integrated • Some Delphi respondents suggested to include more questions on the overall state and prospects of Russian education, science and innovation spheres
Vertical coordination	• Mapping of ongoing and recent cooperation activities at different levels • European nomenclature for societal challenges (Horizon 2020) are used for priority setting of national R&D budgets • Involvement of thematic experts from European Commission in thematic roadmapping workshops between MS/AC and Russia • Foresight project linked to important international event (2014 EU–Russia Year of Science)	• Regional level was not systematically integrated in the foresight design
Horizontal coordination	• Structural foresight focusing on wider issues than just R&I (such as education systems, business environment, migration policy, cultural issues, regulatory framework, etc.) • Thematic foresight departs from interdisciplinary societal challenges • Experts from a wide variety of scientific fields involved in scenario workshops, Delphi and thematic workshops • Thematic workshops were coordinated by non-thematic experts	• Involvement of relevant other ministries/departments at national level was not structurally part of the foresight design • User involvement was limited to researchers and did not include end-users/citizens/interest groups • Delphi to some extent biassed towards basic research due to sample selection
Temporal coordination	• Structural foresight focusing on medium and long term (e.g., EU–Russia S&T cooperation scenarios up to the year 2020), thematic foresight focusing on short and medium term (e.g., via selecting topics for an imminent call for research projects) • Structural foresight addresses the issue of sustainability over time of the S&T cooperation • Vision paper and action plan address short and long term • Structural scenarios include structural roadmaps with milestones up to 2020 • Differences in policy cycles addressed in the vision paper	• Mapping of duration of current national programmes in selected thematic areas could have been relevant
Multilateral coordination	• Mapping of ongoing and recent bilateral and multilateral cooperation activities at varying levels (regional, national, transnational) • Bilingual Delphi questionnaires[a] and attention to semantic differences • Multilateral and multilevel voting: In the two voting rounds in each thematic workshop topics are only taken into account when EU MS/AC and Russian partners assign substantial votes (applying single voting: one vote maximum from each organisation for the same topic) • Action plan addresses actions from multilevel and multilateral actors	• More variable geometry thematic cooperation alternatives between different non-hierarchical governance levels could be interesting to explore (e.g., a MS, a region of an AC, and Russia)

[a] Both questionnaires were not completely independent from each other. The EU MS/AC target group included a limited number of Russian experts, who reside permanently or temporarily in the EU MS/AC. The same goes for the Russian target group.

structured foresight approach. In ERA.Net RUS, sufficient response rate was generated for the Delphi surveys by involving the right target groups and by designing an appropriate questionnaire (through a technical solution it was possible to bring the whole of the societal challenges and thematic areas on one page). Getting access to qualified and high level experts for expert workshops is another example.

Communicating foresight results to the appropriate policy makers and decision takers is essential for achieving impact with foresight. The appropriate means, the form of presentation of foresight results and the suitable events for communicating the results are crucial issues here. The thematic foresight in the ERA.Net RUS project was helped by the initial project and foresight set-up. It was embedded in the ERA-NET project and had direct access to the funding organisations and policy makers in ministries, as well as to the European Commission. With regard to strategies for communicating foresight results to relevant policy makers at EU and national levels (e.g., in Russia) the following strategy was applied:

- *Concise and timely communication*: The results of the workshops, in particular the topics for R&D cooperation, were in a first step communicated back by e-mail to the funding organisations and to the European Commission (who was preparing the 2014 Work Programme for Horizon 2020 at that time). A concise document was prepared for each of the four thematic fields, which included the topics selected, short topic descriptions of one to two paragraphs, and the results of prioritisation (votings). This document was

Fig. 6. Barriers to increased EU–Russia S&T cooperation.

submitted, while the full set of documentation (minutes of the meeting, roadmaps, etc.) was made available at a dedicated webpage with restricted access.

- *Targeted and personalised communication at different levels*: The topics ranked in the first three places in each of the four broad fields (health, nanotech, SSH, environment and climate change) were used by the funding parties of the ERA.Net RUS Plus call for shaping the call text. Also the jointly developed topic descriptions (see example Fig. 5) were copied into the call text. The remaining priority topics (beyond the top three in each field) were disseminated for potential application in bilateral R&D cooperation schemes and for national priority setting.[19] In the communication to the European Commission, the thematic directorates concerned with the topics were provided with the topics for consideration in upcoming Horizon 2020 calls, in particular for providing input for upcoming calls targeted at involvement of Russia.
- *Embed results in wider events with high visibility*: In a next step the results were included in the ERA.Net RUS vision paper on future cooperation perspectives and presented in detail at a vision workshop in July 2013 to the funding organisations. The final formal approval of the call topics was done by funding organisations involved in the ERA.Net RUS Plus at its kick-off meeting in November 2013. This meeting coincided with the official launch of the EU–Russia Year of Science 2014 which added impact as well as public relations coverage for the foresight results.
- *Focus on 'low hanging fruits'*: one way of implementing thematic foresight results was to map currently ongoing or recent initiatives at EU level where Russia is not yet involved as a partner. This overview offered practical advice for Russian funding organisations on where they could consider a participation in international joint funding activities in the near future. See Table 8 for an overview of possibilities that was integrated in the final foresight report.

To summarise the communication strategies used, we can point out that a combination of early and sufficient involvement of the relevant actors from both the EU MS/AC and from Russia, of suitable events, of targeted communication to the policy makers and decision takers, and concise presentation of results proved successful in the case concerned.

4.2. Policy implications

In the context of addressing societal challenges at a global level the above framework has been tested in an EU–Russia environment. As discussed in the introduction, global joint challenges require global joint actions, not only at research performance level but also at programming level. While the case illustrated does not represent a global cooperation, the approach applied showcases how two world regions can work together towards jointly programming research efforts in domains of joint interest. It is a first step towards creating global joint programme cooperation, involving several world regions across the globe. Towards such endeavour the current approach may offer clearer guidance to the decision-making processes at global level concerning S&T priority setting and cooperation. Global foresight exercises do exist, but it is hard to find initiatives that are initiated by relevant decision-makers themselves.[20] Instead, they are often initiated by specific interest groups or non-profit organisations (such as the Millennium project[21]). A clear framework for priority setting in S&T cooperation could have the potential to convince policy-makers to engage in and get ownership of such studies from the start. Future practices in the EU should also aim to represent bigger budgets than is currently the case in order to obtain more critical mass. In this perspective balancing out interests of diverse stakeholder groups becomes even more important.

[19] No attention was paid to dissemination at regional level so far. As also indicated in Table 6 under vertical coordination, the regional level could have been taken better into account in the case.

[20] One example is the International Energy Agency (www.iea.org), whose members are 29 countries worldwide, and which publishes annual prospective reports related to energy (World Energy Outlooks and Energy Technology Perspectives).

[21] www.millennium-project.org.

Table 7
Application of foresight principles for large-scale foresight to the case of ERA.Net RUS.

Foresight principle	Application of foresight principles to the ERA.Net RUS case
Scalability	• Different levels of abstraction were used in the thematic Delphi questionnaire (see e.g., Fig. 2, starting with broad and general research areas, going down to detailed and specific research topics) and in the thematic roadmapping design (see e.g., Fig. 3). In the Delphi researchers could vote at three different levels of abstraction at the same time (both for societal challenges and for research areas) (Input scalability) • A two round voting was organised in each workshop, both for general and for specific priority areas, with each round being independent from the other round. Topics only receiving votes from Russia or only from EU MS/AC were eliminated (multiple votes for the same topic were not allowed). In the specification of the most relevant topics, the rankings resulting from the two voting rounds were taken as first orientation point (input and administrative scalability) • Topics and challenges, which overlapped were merged into thematic clusters. The final topics were formulated in consensus among the participating scientific experts, under the guidance of the foresight moderators (administrative scalability) • Experts from varying countries/regions (geographical scalability), backgrounds and sectors • Open questions in structural Delphi delivered information from very different levels of granularity, that was merged and regrouped into key messages
Modularity	• Structural and thematic foresight ran in parallel but with key interaction points, e.g., structural scenarios include a thematic future dimension • Generic roadmap development ran in parallel with Delphi round 2 and were brought together in the thematic workshops • An English and a Russian questionnaires were used that ran separately and in parallel
Flexibility	• Flexibility, especially during the thematic workshops was crucial for adapting the foresight design and management to decisions taken on the spot about certain tensions in setting joint research priorities • Due to the fact that thematic interviews did not prove to be a sufficiently productive methodological approach to specify relevant thematic areas for the cooperation, the focus of the second round Delphi was partially shifted to assessing the importance of societal challenges and thematic fields which became a main part of our second Delphi survey round.

4.3. Future research

Future research may focus on how such practical model for cooperation can be standardised and adapted to other initiatives, within Europe, but also in and with other parts of the world. Cultural issues, differences in national research systems, imbalances in available budgets between countries, different values and political decision-making processes etc. may all affect the way in which such model is implemented in different parts of the world. Future research on other cooperation models and testing of the above presented model in different contexts are needed to further advance the area of joint S&T priority setting in support of addressing global challenges. Also the use of other FTA methods than those applied to the case could help in increasing the robustness of existing models. As the focus in this paper has been mainly on qualitative methods, one option could be to test quantitative FTA approaches on their potential added value for models of cooperation.

5. Conclusions

Common global societal challenges require common answers, also in programming research to help offer those answers. This paper has proposed a framework for multilateral S&T programme cooperation, in order to provide joint answers to common societal challenges. The proposed framework can be used as an assessment tool of past large-scale foresight exercises, to show policy-makers and other users of the foresight results

Table 8
Existing Initiatives in the EU related to the topics identified for EU MS/AC — Russia S&T cooperation in the ERA.Net RUS Plus.

Existing initiatives in the EU related to the topics identified for EU MS/AC — Russia S&T cooperation in the ERA.Net RUS Plus			
Health	Nano	SSH	Environment and climate change
AAL Art. 185	EMRP Art. 185	JPI Urban Europe	BONUS Art. 185
EDCTP Art. 185	M-era.NET	EIP Smart Cities	EMRP Art. 185
EMRP Art. 185		Ruragri	BIODIVERSA2
NEURON II ERA-NET		Cultural Heritage ERANET+	CIRCLE-2
JPI Neurodegenerative diseases		JPI Cultural Heritage	ERA-ARD-II
EUROCOURSE			CRUE ERA-NET
INFECT-ERA			JPI climate Clik'eu
TRANSCAN			CRIE ERA-NET
EURANID			JPI cultural heritage
			JPI healthy and productive seas and oceans
			JPI water challenges
			Acqueau
			Seas-ERA
			EIP water efficient Europe
			ERA-MIN
			JPI urban Europe
			EIP smart cities
			MARTEC II
			ERA-NET TRANSPORT II
			ERA-NET AirTn

that those results are based on a structured approach taking into account the complexity of multilevel multilateral programming. This has been illustrated for the assessment of the S&T collaboration between Russia and EU Member States/Associated Countries. The framework can also be used as a tool for the design, management and implementation of new foresight exercises, which may increase trust in the foresight outcomes, and in turn increase policy impact of the foresight exercise. This paper using a case of collaboration between two world regions is a first step towards creating approaches for global joint programme cooperation, involving several world regions across the globe, in order to globally address global challenges with joint research programming.

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