THE RELEVANCE OF FORESIGHT FOR SUPPORTING RESEARCH INFRASTRUCTURE POLICIES

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Abstract

Investments in research infrastructures (RIs) are costly, and thus would require thorough and transparent decision-preparatory processes. Yet, in most countries RI policies are devised behind closed doors, by a handful of decision-makers. The paper first provides an brief overview of RI policy-setting processes in ten Central and South-East European countries and then considers the benefits of foresight for RI development policies. Its analytical framework is guided by evolutionary economics of innovation and the theory of participatory decision-preparation processes, in particular foresight.

RI policy challenges call for a radical overhaul of decision-making practices. The paper argues that foresight can support these changes. Decisions on building new RIs and upgrading existing ones present a complex challenge. There is a wide range of stakeholders, with their diverging, occasionally conflicting, interests; while stakes are high in terms of future R&D activities and results, with their repercussions on socially, environmentally, and economically sustainable development. Strategic choices have to be made, with significant immediate financial implications, and potentially huge long-term impacts; while the funding constraints are severe, opinions on proposed RI investments might differ significantly and no evidence exists in a strict sense. Foresight can contribute to tackle these challenges via reducing uncertainties by identifying multiple futures and different policy options. It can also assist policy-makers in devising better informed decisions by bringing together stakeholders with their diverse, complementary knowledge, obtaining public support due to transparent processes, and thus improving the efficacy of RI policies and efficiency of public spending.

Obstacles, tensions, and methodological dilemmas related to transparent, participatory RI policy-making methods and processes are also considered in the paper. These include the overall decision-making culture in a given country (especially for STI policy-making); organisational instability of STI policy-making bodies; the legacy of ESFRI; embeddedness in decision-making structures vs. autonomy of foresight processes; idiosyncratic features of various S&T domains and their RIs; multiple 'futures' for RIs; the choice between a fully-fledged, visible foresight process vs. 'assumed' foresight-like activities.

The paper concludes with policy recommendations, addressing EU-level and national RI decision-makers.

Keywords: Research infrastructure (RI) policy-setting process in Central and South-East European countries; The relevance of foresight in tackling major RI policy issues; Obstacles, tensions, and methodological dilemmas related to foresight on RI policy issues

1 INTRODUCTION

Investment in research infrastructures (RIs) – either establishing a new one or upgrading an existing one – is been costly, and thus would require a thorough and transparent decision-preparatory process. Yet, in most countries RI policies are devised behind closed doors, usually involving only a handful of experts and policy-makers, but in the case of really expensive projects, and/or when national security or prestige has been at stake, politicians, too.

The paper first provides a brief overview of the main characteristics of RI policy-setting processes in ten Central and South-East European countries.[1] Then it discusses five major RI policy challenges that call for a radical overhaul of decision-making practices. The paper argues that foresight is a relevant policy preparation tool to support these changes, by presenting major features of foresight. Obstacles, tensions, and methodological dilemmas related to transparent, participatory RI policy-making methods and processes are also considered in the paper. Policy recommendations, addressing EU-level and national RI decision-makers, are drawn in the concluding section.

2 THEORETICAL FRAMEWORK AND METHODOLOGICAL APPROACH

The paper's analytical framework is guided by evolutionary economics of innovation and the theory of participatory decision-preparation processes, in particular foresight. Its draws on an on-going project involving RI policy-makers and policy analysts from ten Central and South-East European countries. Country notes are being prepared by the consortium members at the time of writing on RI policy practices – especially on the methods and processes used to set RI development policies and on policy tools promoting co-operation among RIs and businesses – in these countries and four workshops were organised on these issues in 2017-2018, with contributions by policy-makers and external experts, and business people.

The paper also draws on the author's experience as a member of the expert team supporting the National Research Infrastructure Survey and Roadmap (with its Hungarian abbreviation: NEKIFUT) project, run between 2008 and 2015, with several fairly long 'interludes' in this period, mainly due to the frequent reorganisations of the sponsoring government body. Further, the author contributed to the *ForIntegra-RI: Integrating Foresight in Research Infrastructure Policy Formulation* (EU RTD FP6) project in 2006–2007 and lessons from that project are also incorporated into the current analysis. Finally, the paper also relies on the relevant grey and academic literature, but space limits do not allow to provide a comprehensive literature review here.

3 RESULTS, DISCUSSION AND IMPLICATIONS

3.1 RI policy-setting processes in Central and South-East European countries

The ResInfra@DR project has considered the main aspects of RI policy-setting policies in the Danube macro region: the tools and methods applied to devise national RI development roadmaps, as well as for preparing proposals for the ESFRI (European Strategy Forum on Research Infrastructures) Roadmap; the actors and stakeholders involved in these strategy-setting processes; the types and extent of international (macro regional) co-operation in investing in and using RIs.

In brief, hardly any of these countries have offered proposals for devising – and revising – the ESFRI Roadmap, and thus there has been no need to rely on any strategy-setting tools and processes. Major universities, other publicly financed R&D performing organisations and

[1] Financial support by the EU Interreg Danube Transnational Programme through the ResInfra@DR project is gratefully acknowledged.

influential researchers have expressed their wish as to which RI, already on the ESFRI Roadmap, their country should join.[2]

As for devising the national RI development roadmaps of these countries, suggestions on individual RI projects – either building new RIs or upgrading existing ones – have been collected and assessed by various committees. These proposals have been also submitted by major universities, other publicly financed R&D performing organisations and influential researchers, just as in the case of the ESFRI Roadmap. In other words, no overall strategic analyses have been performed, let alone using participatory methods and processes.[3]

The Hungarian NEKIFUT project was the only exception to this rule – but only to some extent. NEKIFUT was a strategy process to assist Hungarian RI policies (upgrading the domestic RIs, building new ones, gaining access to, and effectively utilising, transnational RIs). Although it was not a stand-alone and fully-fledged foresight process, *per se*, it followed foresight-like approaches, and relied on some elements of the foresight toolkit. Most prominently, it was intended to be a participatory process, reaping the so-called process benefits (5 Cs in foresight jargon). The members of the Steering Group (SG), as well as those of the 3 Working Groups (WG, each representing a major field of sciences) were selected consciously to represent major stakeholder groups: researchers working for universities, publicly financed research institutes (to a large extent belonging to the Hungarian Academy of Sciences), and business R&D units. Business people were also involved as SG members. Policy-makers were represented by the launching government agency, that is, the National Office for Research and Technology.[4] Further policy-makers were to be involved as members of an inter-ministerial group, which was never set up, due to the constant re-organisation of the STI policy governance system. In sum, NEKIFUT was the first strategy project in Hungary in the field of RI policies, meant to follow three underlying principles: being participatory, transparent, and systematic.

The NEKIFUT project first devised new definitions of RIs and RIs with strategic relevance (SRI), relying on a broad consultation process.[5] Then a registry of SRIs and RIs was to be set up, although originally the RIs ("registered RIs") were not to be included in the registry, and thus it was a demanding new task. Yet, the participants felt a strong need to compile the RI registry in this way to provide a sound basis for the RI development strategy: without having a through, detailed map of the existing RI capacities it would have been really difficult to formulate a sound, convincing RI policy strategy. The registry was meant to serve various types of needs and purposes, and thus the detailed questionnaire, used to collect primary information, was designed in keeping these needs and purposes in mind. The idea was that the registry would

- make RIs visible, and hence facilitate co-operation between various types of users and RIs, thereby increasing the capacity utilisation of RIs and generating revenues for them;
- provide inputs on RIs for policy analysts and policy-makers (to analyse and assess the use, operation, and scientific and socio-economic impacts of RIs).

The SRI register was published in April 2011, its search interface was publicly available in Hungarian and in English. Two major future activities were also planned at that time. First, the launch of the RI register. The idea was to give an option to those research infrastructures

[2] Details can be found in the presentations given at the first ResInfra@DR dialogue workshop, held on 31 August 2017 in Budapest, as well as in official documents submitted to the European Commission by some of these countries.
[3] Details can be found in the presentations given at the second ResInfra@DR dialogue workshop, held on 12 September 2017 in Sofia, as well as in official documents submitted to the European Commission by some of these countries.
[4] Subsequently, as already hinted at, this government body was re-organised and renamed several times.
[5] A third type of RI was also identified and defined, the so-called background infrastructures for research.

that were not granted the SRI status to request to be included in the NEKIFUT system, to ensure visibility of their services.

The second important future task would have been the regular update of the SRI register. That would have meant to award the SRI status to new infrastructures, as well as to review SRIs that are already present in the register. The software developed for the NEKIFUT project supported this task, too.

NEKIFUT had been mainly financed from the Research and Technological Innovation Fund until June 2010. All activities financed by this Fund were frozen by the incoming government in June 2010, and thus a new decision was needed if the project is to be completed. The NEKIFUT project, although it was presented to the EU Competitiveness Council in April of 2011, and hence the register was made live, was suspended until early 2013. Then the necessary update of the SRI register was performed and work started again on the roadmap.

Work on the roadmap was side-lined several times. The management team and the panel members of the NEKIFUT project were continuously overwhelmed by the other – partly unforeseen, extra – tasks of the project. They were also more enthusiastic about developing an immediately useful, new practical tool, which could have made the life of RI operators and RI users easier. Moreover, most participants did not have any experience in using prospective methods – and were too busy to be trained.

Several methodological paths had been started and experimented with. Important drivers of future developments were identified via group work, followed by broader on-line consultations, including open questions, too. Multiple visions for RI developments and/or RI policies were also devised. Eventually a fairly simple, less demanding method was chosen. Major RI-relevant S&T trends were identified by thematic groups (formed by panel members and invited external experts), to be complemented by SWOT analyses of RIs relevant to identified S&T trends. Various types of background analyses were also conducted, e.g. using bibliometrics and statistics on RI investments. The idea was to derive policy recommendations, by pulling together these threads, in the form of a roadmap for RI development, as well as proposals on an appropriate RI policy rationale, methods to prepare and implement RI policy decisions, and RI policy tools to be used. But the NEKIFUT project was suspended again.

After a long pause there was a short-lived hope to start a new RI roadmap project in 2015 with a time horizon of 2020. A project plan was devised by a group of experts, composed of partly by the former NEKIFUT management team, partly by new members. The responsible government office was reorganised and renamed in January 2015 and the new president of the office declared the NEKIFUT project completed in a letter sent to the SG members on 9 January 2015. Although the update of the SRI register was mentioned in that letter together with the opening of the new RI register, nothing has happened since then – except making the SRI register unavailable.

In sum, the NEKIFUT process has produced numerous valuable outputs, including the development of indispensable tools and methods for RI policy-making, the definition of various infrastructure categories, an internationally novel method for their classification, the assessment and classification of existing research infrastructures, the development of the necessary IT basis both for the decision-making processes and the SRI and RI registers, and prospective analyses to underpin RI development strategies. Hundreds of people were working for years. Not only all their results are lost, but also their faith in participatory decision-preparatory processes.

3.2 Policies for research infrastructure and the relevance of foresight

The relevance of foresight for RI policies can be best demonstrated by discussing five major issues in this domain, clearly showing a need for fundamental changes in decision-making practices. First, the most visible and pressing factor is the sheer cost of building new RIs, on

the one hand, and that of upgrading the existing ones, on the other. Envisaged RIs, which are crucial for dealing with fundamental scientific, environmental or other socio-economic challenges, and thus to be built in the coming years, tend to be large projects. Some of these would require an EU-wide co-operation, or at least the collaboration of several countries to build and run them. Besides, many critical facilities across the European Union have to be modernised and/or re-oriented as they are nearing the end of their useful life. Simply not all these new investments can be financed, and thus choices have to be made, as well as other sources of funding should be mobilised.

Second, those RIs, which are to be built and run by international co-operation, pose further challenges for policy-makers, beyond raising the funds required. These RIs need a long lead time and wide-ranging expertise to be developed, as well as a sustainable institutional and organisational frame that allows them to be open to, and used by, the largest interested community of scientists, businesses, and other potential users. Thus, budget cycles, financial rules and priorities of the participating countries need to be aligned in the long run; new, appropriate governance structures are to be set up, preserving open access based on excellence; and political negotiations on site selection should be concluded.

Third, given the importance of RIs – their role in addressing major challenges, and thus the socio-economic consequences of their operation; the financial implications of building and maintaining appropriate RIs; etc. – major stakeholders need to be involved when strategic decisions are to be made on RIs. Beyond scientists and managers of RIs, and policy-makers, these include users and potential users, as well as citizens in many cases.[6]

Fourth, many RIs are exploited below the socially optimal level. Some experts, therefore, suggest that a shift in emphasis is required – away from concerns about funding new or upgraded RIs towards better use and management of existing RIs. Funding, interoperability, open access on the basis of merit, meeting educational and training needs, and data conservation are thus central management concerns. These issues require strategic responses that take a long view – but the necessary strategic capabilities are underdeveloped in many facilities. Moreover, better co-ordination of RIs is needed, both at national and EU levels, to achieve more efficient utilisation of resources and skills. Further efforts are also required to reduce the duplication and sub-optimal use of resources given the current lack of co-ordination.

Finally, and most fundamentally, the way in which knowledge is generated should be reconsidered, and thus the role of RIs is to be revisited, too. Clearly, this requires a proper, thorough dialogue and understanding between the co-producers and users of knowledge, including businesses, policy-makers, researchers working for publicly financed research organisations (including universities), as well as the representatives of the civil society. Publicly financed research organisations and RIs – here put together as research systems (RS) – are still playing a predominant role in producing knowledge. Research systems, in turn, can be organised in various ways, taking into account their main rationale: knowledge can be produced for distinct purposes, and thus public research organisations are governed in different ways. Mechanisms and tools for setting their agenda, evaluating their activities and disseminating their results are defined accordingly. RIs are also arranged in this broader logic, aligned with the overall rationale of a research system.

Three types of RS can be distinguished as starting points for such dialogues: (i) *'Pure science RS'* with the main goal to boost national prestige by achieving scientific excellence; (ii) *'Business oriented RS'*, organised to produce S&T results meeting businesses' needs, and hence enhance their competitiveness; and (iii) *'Citizen oriented RS',* aimed at achieving S&T results to improve quality of life.[7] These RS are to be understood as 'ideal types' (as defined by Max Weber); i.e. none of them could be found in historical (actual) cases. They

[6] It is particularly important when the RIs in question are critical from the point of view of quality of life (e.g. they concern environmental issues, or food quality and safety); or ethical issues, etc.
[7] Further details are presented in Keenan et al. [2007], p. 9.

are sharp characterisations of distinct research systems – rather than descriptions of any 'real life' case. The aim of distinguishing these three ideal types is to highlight the major differences among different types of RS: these might be important inputs when considering different RI policy stances, as well as broad organisational and institutional arrangements for RSs.

In sum, decisions on building new RIs and upgrading existing ones present a complex challenge. There is a wide range of stakeholders, with their different, and sometimes even conflicting interests; while there is a lot at stake in terms of future scientific capabilities, with their consequences on socially, environmentally, and economically sustainable development. Strategic choices have to be made, with significant immediate financial repercussions, and potentially huge long-term implications – while the constraints are severe, the opinions on proposed RI investment projects might significantly differ, and no evidence exists in a strict sense. Foresight is definitely not a panacea to address this complex challenge, but can assist decision-makers. It can reduce technological, economic or social uncertainties by identifying multiple futures and various policy options, make better informed decisions by bringing together different communities of practice with their complementary knowledge and experience, obtain public support by improving transparency, and thus improve overall efficiency of public spending.

3.3 Major features of foresight processes

At a more general level, several salient features of foresight processes seem to be highly beneficial when tackling RI policy issues.

Foresight is a future-oriented activity, though not in a predictive sense: it assumes that the future is not pre-determined, but can evolve in different directions, depending upon the actions of various players and the decisions taken today. In other words, the future can be actively shaped, at least to some extent, and there is a certain degree of freedom to choose among multiple, plausible futures, and hence to increase the likelihood of arriving at a preferred future state.

Foresight values the multiplicity of perspectives, interests, and knowledge held across a dispersed landscape of actors, and seeks to bring these together in processes of deliberation, analysis, and synthesis. As the results of foresight often have implications for a wide variety of actors, it is particularly important to involve the major stakeholders as far as possible throughout the process.

Foresight relies upon informed opinion and interpretation, as well as creative approaches in formulating conjectures on the future. However, these are seldom sufficient on their own and are complemented with various sorts of data from trend analyses and forecasting, bibliometrics, and official statistics, among other sources.

Foresight recognises that many of the problems we face today cannot be understood from a single perspective nor the solutions found within a single discipline. Accordingly, foresight intentionally seeks to transcend traditional epistemic boundaries, bringing together different disciplines in processes of deliberation that result in improved understanding and new working relationships.

Foresight enrols multiple actors to participate in decision arenas where conjectures on the future are contested and debated. Supported by various data and opinion, the foresight process aligns participant actors around emergent agendas, resulting in a coordinated mobilisation of people and resources.

Foresight is not only about analysing or contemplating future developments but supporting actors to actively shape the future. Therefore, foresight activities should only be undertaken when it is possible to act upon the results.

3.4 Issues for foresight on RI

3.4.1 Policy co-ordination

Efficient use of public funds would require a more effective orchestration of RI policies with broader science, technology and innovation (STI) policies. Just to mention a single aspect, RIs are operated in a large number of scientific domains, with their own specific features and needs, and all these have to be taken into account when devising science, technology and innovation (STI) policies. Although it is already so complex a chain, that it seems unmanageable, actually the need for co-ordination possibly goes even beyond: other policy domains, which interact with STI policies with regards to socially, environmentally, and economically sustainable development should also be aligned with the help of broad strategies, underpinned by foresight.

3.4.2 Use of existing RIs

Foresight can tackle the gap between the current operation of existing RIs and their potentially more efficient use by devising and systematically considering alternative governance, organisational and financial models.

3.4.3 Future needs vs. existing RIs

Foresight can thoroughly explore the gap between the current RIs and future needs, derived from likely S&T, environmental, societal and economic developments, and by doing so, offer 'future-proof' RI strategies.

Several issues deserve special attention when running foresight processes to consider this broad gap.

More efficient exploitation of existing knowledge vs. generation of new knowledge

When considering if future socio-economic and S&T needs would necessitate the building of a new RI facility, it is crucial to assess whether existing knowledge, available at RIs, could be better harnessed. Some experts even suggest that knowledge transfer needs to be prioritised over new knowledge generation and call for the development of increased capacities in this area. It is helpful to think of this issue by considering two options: (i) are there better ways to unlock a repository of knowledge, and would those be sufficient; or (ii) is there a need to change the way in which knowledge is generated in the first place? (see the three ideal types of research systems, presented in the previous section)

The life cycle of the RIs

The financial implications of building and running RIs – the budget constraints, from a different angle – should be assessed in a comprehensive way: the long-run maintenance costs of existing and new RIs should be considered as a single issue. A closely related question concerns the decommissioning of RIs: how and when to close obsolete RIs (taking into account financial, employment, environmental, S&T and broader socio-economic implications).

International co-operation and competition

In the case of RIs with an EU-wide significance, it is essential to have a sound understanding of the specific needs, roles and capabilities of the (soon) 27 members of the EU: how they could contribute to the building or running these RIs and how they could benefit from their operations. Most likely new models of co-operation are also needed to run these RIs, either by inventing truly new models, or reinventing some of the existing ones. A closely related aspect is to strike a balance between co-operation and competition among the EU members; but this issue can – and in many cases should – be considered at a global scale, too. Further, funding and eligibility rules to encourage collaboration and co-investment have also

to be developed. Finally, regulations on intellectual property rights and ethical issues should also be aligned among the participating countries.

3.4.4 People

RI policies should not consider only 'hardware', i.e. the tangible assets – people are equally important, but this aspect is often eclipsed because of the apparently more important financial or political considerations (how much to spend on RI, where to locate it, etc.). To rectify this deficiency, strategies on RI should be aligned with education and broader human resources policies: the current stock and flow of researchers who can strategically manage and govern RIs, and other highly skilled people who can exploit these services; the balance between future HR needs and the supply of skilled people; the various forms of training tailored to the future generation of researchers; life-long learning for the current generation to prepare them for meeting future challenges; career opportunities for people with these special skills; diffusion and exploitation of knowledge via the mobility of people (between sectors: e.g. RI, businesses, policy-making, NGOs; as well as between regions and countries inside and outside the EU).

Pulling together these four issues, foresight processes bring together the relevant stakeholders to consider the future needs, on the one hand, and can mobilise their expertise and experience to judge if the operation of existing RIs can be modified to meet the future needs or new RIs should be built, on the other. As a result, RIs can better serve the respective innovation systems. Further, by encouraging systemic and systematic thinking, as well as by bringing together the diverse set of knowledge and skills needed, foresight can facilitate strategic deliberation on complex issues. It also compels developing alternative models drawing on the wide-ranging expertise of the participants. The participants, in turn, would feel 'ownership', and thus their future actions would be driven by the shared understanding of the context ('where we are now'), as well as by shared visions ('what we want to achieve').

3.5 Obstacles, tensions, and methodological dilemmas

To improve the design of future foresight processes to underpin RI policies, it is worth considering various obstacles. tensions, and methodological dilemmas.

i) The overall decision-making culture

In many countries, and especially in Central, South-East and Southern European countries, the decision-making procedures, including those on STI policy issues, tend to be opaque: only a small circle of confidants is involved, and short-term political considerations overrule longer-term policy rationales. Hence, systematic, participatory, and transparent processes, openly presenting and discussing substantially different options are rarely welcome when it comes to actual decision-making.

ii) Organisational instability of STI policy-making bodies

Political and organisational stability are basic pre-conditions of successful policy-setting processes. Another major factor for smooth and efficient project implementation, namely organisational learning, also requires stability. In contrast, the main bodies responsible for STI (including RI) policy formation, co-ordination, decision-making and implementation have been restructured several times in many of the 10 countries covered by the ResInfra@DR project and political instability – frequent changes of the government and reorganisation of STI policy-making bodies – is not restricted to these countries.

iii) The legacy of ESFRI

ESFRI, the European Strategy Forum on Research Infrastructures, has not followed foresight(-like) approaches, and key national RI policy-makers and experts have been

'socialised' in that culture. A strong 'imprinting' is quite natural when people act and interact in a certain 'culture' for years, especially when that community sets the norms for a particular policy domain. It becomes so 'intrinsic' that it takes considerable amount of time just to understand that this background can be counter-productive, and obviously requires an even longer period to change it: conscious efforts and mutual learning are needed to develop a new common language and a set of shared professional norms required to perform the tasks of participatory strategy-setting process.

iv) Idiosyncratic features of various S&T domains and their RIs

Various S&T domains have their own, internal dynamics: their evolution is driven by these properties to a large extent. How to account for this diversity, that is, the idiosyncratic features of S&T domains in a foresight process to underpin RI policies? What is the relation between S&T developments and RIs? Can we derive future RI needs from the inner logic of S&T developments and trends, or do advanced RIs drive S&T developments and trends? In the presence of significant differences among S&T domains in this respect, how can we deal with this variety in a foresight process, which should support a comprehensive, overarching RI development strategy? Do we have appropriate foresight tools to address these issues, or do we need to develop new tools and approaches?

v) Multiple 'futures' for RIs

In case future RI needs can – and indeed, should – be derived from the inner logic of S&T developments and the most favourable (desirable) future concerning the S&T developments is selected, is it meaningful to aim for multiple futures for RIs? Would it be useful in this case to devise multiple futures for RIs by taking into account the overall rationale of an innovation system – and its research sub-system – e.g. by following the distinction between 'pure science', 'business-oriented', and 'citizen-oriented' research sub-systems? A related aspect could be the governance model for RIs – the role and influence of various stakeholders in making strategic decisions –, as well as the access policies of RIs.

vi) Embeddedness in decision-making structures vs. autonomy of foresight processes

There is a general dilemma for all foresight(-like) activities: how to ease an inherent contradiction between the need for a strong (but 'reserved') political support (or 'embeddedness' in important decision-making structures) for a successful foresight process on the one hand, and for intellectual, organisational, and financial independence from any government agency, on the other. There is no 'blueprint' for designing such an organisational set-up; any viable solution can only be context-specific.

vii) A fully-fledged, visible foresight process vs. foresight-like activities 'assumed' in an RI policy-making process

From an abstract, somewhat rigid methodological standpoint one might argue that a 'pure', fully-fledged, clearly visible foresight process should not be compromised; i.e. should not be 'downgraded' (or 'diluted') in order to tailor its methods to meet the requirements of an actual decision-making process, or important elements should not be 'stripped off' because of resource constraints (be they time, funds, or available methodological skills). An opposite, more pragmatic approach could equally forcefully claim that it is better to 'blend' ('melt') some foresight-like activities into an actual decision-preparatory process than aiming at an 'impeccable', easily noticeable foresight process, but with low chances of implementation, given its 'outsider' position. Three inter-related reasons might be thought of to support the latter, pragmatic approach. First, foresight-like activities are likely to yield better informed policy recommendations (compared to those instances where none of these methods is applied). Second, given the embeddedness into an actual decision-preparatory process, there might be higher chances to implement these recommendations. Third, in case of a

sufficient level of participation and 'joint ownership' of recommendations, the prospects of implementation would be even more promising.

Again, and more importantly, this dilemma cannot be solved in an abstract way: the context does matter, and thus the choice between these – somewhat caricatured – options should be made by considering the major features of a given situation.

4 POLICY PROPOSALS

On the basis of the above discussions, five policy proposals can be put forward.

First, use foresight to underpin RI policies, by considering the issues highlighted in sections 3.2 and 3.4. Foresight processes on RI can be initiated and/or financed by national governments (STI policy-making bodies, as well as domain ministries), the ESFRI, Technology Platforms and other EU-wide networks of relevant stakeholders for RI policies, the European Commission, as well as businesses (industry associations, or various groupings at the EU, national, sectoral or regional levels).

Second, consider RI issues in thematic foresight processes, too – besides running foresight on the specific domain on RI policies – whenever the sponsors and participants of those projects are willing to include these issues.

Third, repeat foresight regularly as the world does not stand still: major changes occur in the environment of RI policies, too. Before launching a new round of foresight, assess the impacts of a previous round systematically. It is crucial to bear in mind, however, that exact measurement of impacts is simply not possible given the multitude of factors affecting the performance of RIs (beyond policies and other actions drawn from a foresight exercise). Evaluation of impacts, though, is not only possible, but also desirable, as an important tool for policy learning.

Fourth, do not mistake recommendations stemming from a foresight process with decisions. Two aspects make this distinction important: (i) it is the professional competence of decision-makers to derive decisions from recommendations: filter, revise and reformulate them as appropriate; and (ii) it is their obligation, as well as legal competence, to act upon the recommendation, as only they can do so. In other words, one can expect immediate impacts of a foresight process on decisions – but immediate actions can only be taken by decision-makers. It is also important to note that foresight recommendations might have medium-term impacts, too, on decisions: in many cases these proposals find their way to influence decisions in an indirect way, and thus are implemented with some delays. In sum, foresight cannot provide immediate solutions of today's burning problems; but it can initiate a strategy towards a solution.

Fifth, rely on already available outputs from other foresight programmes ('don't reinvent the wheel'). Given the importance of context, however, do not expect that a foresight process can be 'spared' by simply implementing the recommendations of another foresight programme, conducted in a different milieu, albeit on the same or similar issues.

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