Effective Policies for Research Infrastructure: The role of foresight

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1 Introduction

Establishing and upgrading research infrastructures (RIs) have always been relatively expensive projects, even in those years when the absolute costs were much lower than nowadays. Further, running large RIs can also be rather costly. Thus, although RIs are usually not in the limelight, they can take up a considerable chunk of regional or national R&D budgets, and in some cases they can only be financed via international co-operation, given the funds required. Yet, RI policies have tended to be devised behind close doors, involving only a handful of experts and policy-makers – when national security or prestige has been at stake, politicians, too. The ForeIntegra-RI project,[1] on which this article draws on, has argued that this mode of policy-making needs to be altered, and foresight would be a useful tool to rely on in doing so.

The main line of arguments is organised as follows. Section 2 discusses five policy challenges, which call for a radical overhaul of decision-making practices in RI policies. Then Section 3 argues that foresight[2] is a relevant policy tool to support these changes, by presenting major features of foresight. Section 4 discusses several RI policy issues, which can be tackled by foresight, such as policy-co-ordination; use of existing RIs; future needs vs. existing RIs; human resources to operate RIs and exploitation of RI services. Finally, practical policy recommendations are presented in Section 5, addressing EU-level and national decision-makers.

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.[3]

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[1] For a detailed description of the project, consult http://rifi.gateway.bg/page.php?c=15

[2] Foresight is used in many different – sometimes confusing – ways by various authors. This article uses this term in line with the ideas summarised in Georghiou et al. (eds) [2008].

[3] The Green Paper on ERA (EC, 2007) confirms this observation: "Implementing the ESFRI [the European Strategic Forum on Research Infrastructures] roadmap would cost €14bn over 10 years. Despite the increase in funding allocated to infrastructures in the 7th research Framework Programme and the possibilities for infrastructure-support in less developed regions under cohesion policy programmes, the EU budget is not big

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, customer industries, 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.[4]

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 (hardware) 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 research infrastructures – 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.

The ForeIntegra-RI project has identified three types of RS 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.[5] These RS are to be understood as 'ideal types' (as defined by Max Weber); i.e. none of them could be found in historical

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enough to provide core financing for the construction of new pan-European infrastructures, in addition to supporting open access to infrastructures of European interest and stimulating their coordinated development and networking. The mobilisation of national, private and other sources of funding is essential. Attracting investment from industry is particularly important given its current low level of involvement, even for infrastructures of direct interest." (p. 13)

[4] 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.

[5] Further details are presented in Keenan et al. [2007], p. 9..

(actual) cases. They 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 alternative policies, as well as broad organisational and institutional arrangements for RS.

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 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 alternative 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 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 alternative, 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.

4 Issues for Foresight on RI

1) *Policy co-ordination*

Efficient use of public funds would require a more effective orchestration of RI policies with broader science, technology and innovation 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 fields, 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.

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) *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.

3.1 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 new RI facility, it is crucial to assess whether existing knowledge, available at important RIs, could be better harnessed. Some experts even suggest that knowledge transfer needs to be prioritised over and above new knowledge generation and have called 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)

3.2 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 (financial, employment, environmental, S&T and broader socio-economic implications).

3.3 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 27 members of the EU:

how they could contribute to the building/ 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.

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 RI can be modified to meet the future needs or new RI should be built, on the other. As a result, RI can better serve the respective research and innovation systems broadly, and not just the host/ funded institutes. 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').

5 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 Section 2. Foresight processes on RI can be initiated and/or financed by national governments (STI policy-making bodies, as well as domain ministries), ESFRI, Technology Platforms and other EU-wide networks of relevant stakeholders for RI policies (including the I3 Forum, the CIP Network, IGLO [Informal Group of Liaison Offices]), the European Commission (DG Research and/or 'domain' DGs, e.g. DG Regio), 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.

As a way of supporting these policy proposals, partners in the ForIntegra-RI project has developed a Practical Guide on using foresight to support RI policies. (Keenan et al. [2007]) This guide is aimed at highlighting the specific features of running foresight processes in the particular domain of RIs. Therefore, it explores the specific challenges faced by scientists, RI managers, and policy-makers acting at different levels of governance, and by using hypothetical cases as starting points, explains how foresight can address those challenges.

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