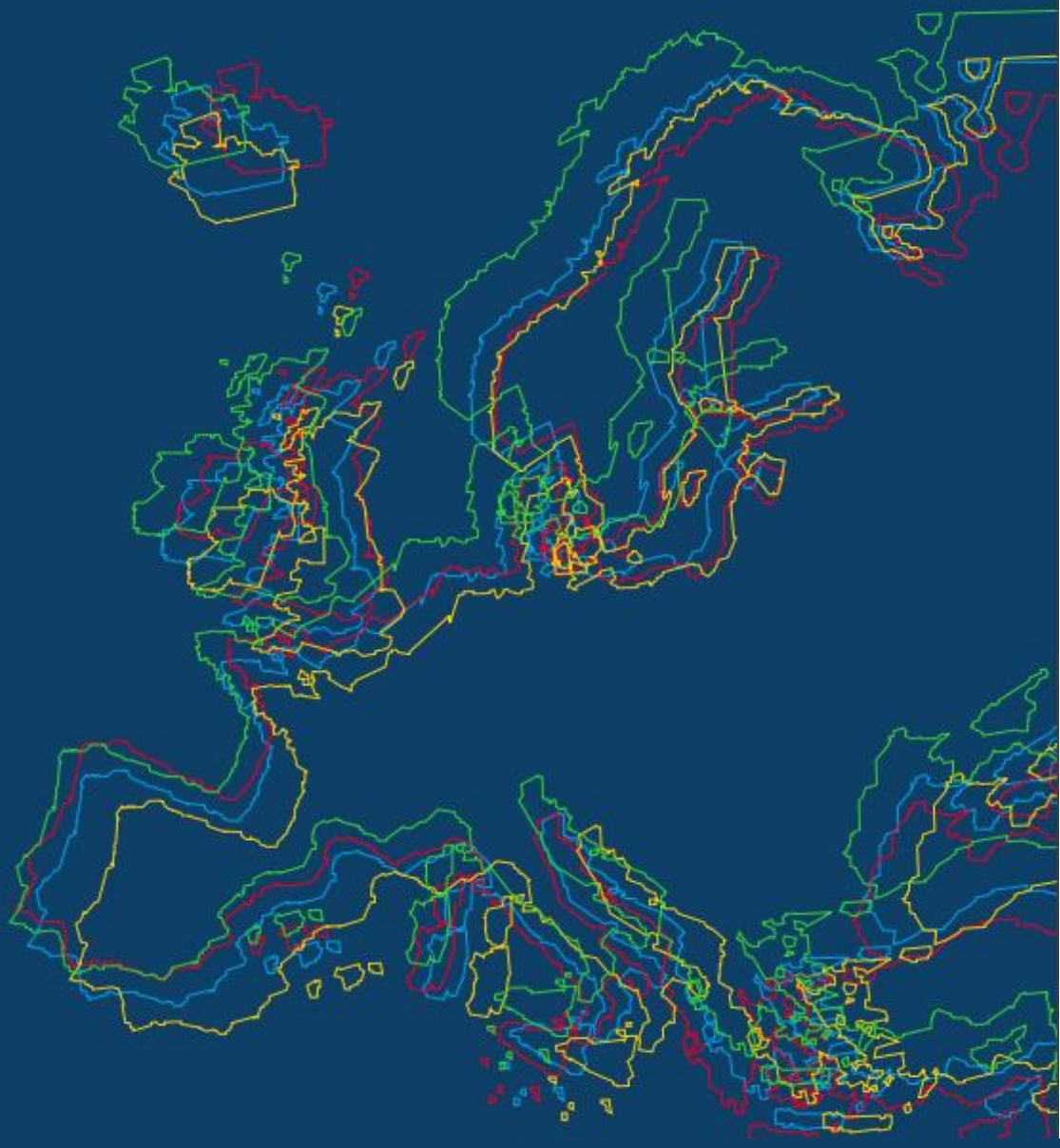
InRoad synchronising research infrastructure roadmapping in Europe



Briefing for InRoad Validation Workshop

01-02. October 2018

Draft findings and policy insights

InRoad has been funded by the European Union's Horizon 2020 Research and Innovation programme under grant agreement No 730928.

MAIN FINDINGS AND POLICY INSIGHTS

COORDINATION BETWEEN NATIONAL AND EUROPEAN RI ROADMAPPING PROCESSES

1 InRoad encourages the development of a common understanding of key elements in national roadmapping processes as a prerequisite for a higher degree of coordination for Research Infrastructure (RI) policy at national and EU level.

1.1 National RI roadmap processes include a regular update of inventories of existing RI and needs for upgrades or new RI, i.e. through landscape analyses.

1.2 National RI roadmap processes include a transparent prioritisation of needs as well as long-term strategic priorities.

1.3 National RI roadmap processes include the evaluation and assessment of the scientific and national relevance and quality of RI.

2 InRoad recommends the use of a minimal set of common evaluation / monitoring criteria, which take into account scientific, managerial and strategic dimensions.

2.1 InRoad suggests taking into account different lifecycle stages and types of RI (e.g. single-sited or distributed) in the evaluation and monitoring methodologies.

EMBEDDING RI ROADMAP PROCESSES IN NATIONAL RESEARCH AND INNOVATION SYSTEMS

3 InRoad encourages better inclusion of RI roadmaps in the national research and innovation system and across other relevant national policies.

4 InRoad encourages user communities to increase their collaboration in the same and/or interdisciplinary thematic areas at regional, national and European level to prioritize their needs with a long-term perspective.

5 InRoad recommends to connect long-term RI funding considerations to the national RI roadmap.

5.1 InRoad recommends consideration of long-term funding needs for RI, including operation and eventually termination or reorientation/upgrade.

HIGHER DEGREE OF COORDINATION BETWEEN REGIONAL, NATIONAL AND EUROPEAN FUNDING FRAMEWORKS

6 InRoad recommends using the lifecycle approach to contribute to the long-term sustainability of RI.

6.1 InRoad encourages EU Member States and Associated Countries to improve financial predictability and stability across the entire lifecycle of RI.

6.2 InRoad stresses the need for a better integration of RI in their related ecosystems.

6.3 InRoad recommends strengthening the support to funding mechanisms for access to and coordination of facilities, notably the EU transnational access instrument.

7 InRoad calls for closer synergies between regional, national and European funding frameworks to promote an integrated European Research Area.

7.1 InRoad calls for greater coherence among the priority-setting tools within research and innovation policies across different levels.

7.2 InRoad recommends an adjustment of the funding regulatory frameworks across different levels, to favour synergies between funding mechanisms.

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8 InRoad calls for fostering mutual learning and cooperation through the exchange of information.

8.1 InRoad encourages further action to improve and facilitate sharing of practices and common development of funding solutions.

8.2 InRoad stresses the importance of developing and adopting structured mechanisms to demonstrate, communicate and disseminate the scientific and strategic relevance of RI, as well as their broader societal impact.

BEST PRACTICES AND COMMON STANDARDS FOR RI BUSINESS PLANNING

9 InRoad advises that RI business plans address at least the following topics:

- Mission and objectives of RI;
- RI user strategy;
- Access policy and data management;
- Governance and management structure;
- Financial and funding framework;
- Stakeholder engagement strategy and communication;
- RI implementation plan and monitoring;
- Ethical and regulatory aspects.

10 InRoad advises that all RI develop a business plan in order to align their strategy, resources and goals.

10.1 InRoad recommends early and continuous stakeholder involvement for the development, implementation and updating of a sound business plan.

10.2 For distributed RI, InRoad recommends that central hubs have a business plan, which serves as guiding framework for the business plans of the nodes to reflect coherent strategies.

10.3 InRoad encourages funders and decision-makers to request business plans as part of application procedures for the national RI roadmap and for funding, and to include them in the evaluation criteria.

10.4 InRoad recommends that business plans are used as a reference for the development of other operational documents.

11 InRoad recommends the use of business plans as a management tool, in the form of a living document aimed at ensuring the long-term sustainability of the RI.

11.1 InRoad recommends that all RI use the business plan as a strategic tool to connect their mission with national and international strategic research agendas.

11.2 InRoad stresses the importance of short-term and long-term financial forecasting.

11.3 InRoad encourages using and periodically updating the business plan throughout the entire RI lifecycle.

12 InRoad calls for the professionalization of business plan drafting and implementation.

12.1 InRoad encourages the development of human resources strategies to attract and retain personnel with financial and managerial experience.

12.2 InRoad encourages the development of training schemes, the exchange of practices and mutual learning exercises for RI managers.

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DEFINITIONS IN THE CONTEXT OF THIS BRIEFING NOTE

The InRoad consultation and compendium as well as the analysis of documents related to national RI roadmapping processes revealed a great variety of terms and definitions used between countries. In this section, we propose a list of common terminology used throughout this briefing note.

Business plan	Concrete, operational and budgeted translation of the business model. Formal document which should describe the organisation's strategy and vision, how the business model will be implemented, and expectations regarding the development of the organisation's activities and finances. (OECD 2017)
Distributed RI	A distributed RI consists of a Central Hub and interlinked National Nodes. The essential features are: 1) a unique specific name, legal status and a governance structure with clear responsibilities and reporting lines, including international supervisory and relevant external advisory bodies; 2) legally binding attributions of coordination competences and resources to the Central Hub; 3) a unique access policy and provide for a single point of access for all users with a support structure dedicated to optimise the access for the proposed research (ESFRI 2018).
European Structural and Investment Funds (ESIF)	European Regional Development Fund (ERDF), Cohesion Fund, European Social Fund (ESF), European Agricultural Fund for Rural Development (EAFRD) and European Maritime and Fisheries Fund (EMFF) (Adapted from European Commission 2015 for InRoad).
Evaluation	The peer-review process of assessing RI proposals regarding scientific excellence, relevance, feasibility and impact (InRoad 2018).
Inventory of RI	Inventory of all existing RI of a predefined definition (e. g. size, thematic area, access policy, lifecycle stage, relevance) (InRoad 2018).
Key Performance Indicator (KPI)	Metric that is used to track the performance, effectiveness or efficiency of a service or process. KPI are generally important metrics that will be aligned to critical success players and important goals. KPI are therefore a subset of all possible indicators, intended to allow for monitoring [see also indicator] (Adapted from European Commission 2017 for InRoad).
Landscape Analysis	Analysis of the RI ecosystem based on the identification of the main RI operating in a given geographical area, e.g. national or European, as well as planned projects and existing gaps. This typically includes an analysis of strategic elements, e.g. strengths and weaknesses, outputs and services, and growth models. (Adapted from IAC Publishing 2017 and ESFRI 2016 for InRoad)
Monitoring	The continuous process of assessing the performance of RI including the delivery of outputs and supply of services to intended beneficiaries. It is carried out during the lifecycle of RI with the intention of correcting any deviation from operational objectives [ESFRI sometimes uses the term "interim evaluation" instead of monitoring] (ESFRI 2011).
Operational costs	Operational costs refer to day-today costs of operations derived from running RI services. They include personnel costs, equipment maintenance cost, consumables, etc. (Adapted from Wikimedia Foundation 2017 for InRoad)
Research Infrastructure	Facilities, resources and services that are used by the user communities to conduct research and foster innovation in their fields. They include major scientific equipment (or sets of instruments), knowledge-based resources such as collections, archives or scientific data and e-infrastructures such as data and computing systems and communication networks. Such infrastructures may be "single-sited", "virtual" or "distributed" (European Commission 2010, ESFRI 2011).
RI lifecycle	The lifecycle of an RI includes concept development, design, preparation, implementation, operation and termination. (ESFRI2016)
Roadmap	Strategic plans elaborated jointly by scientists, managers, funders and

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	policymakers, under the aegis of the latter, with well-defined explicitly-stated contexts, goals, procedures and outcomes. (…) Typically, it involves the organization of extensive "bottom-up" consultations, leading to tough choices among competing projects. (Adapted from OECD 2008 for InRoad)
Roadmapping processes	The entire process by which a roadmap is created, implemented, monitored and updated as necessary. (International Energy Agency 2014)
Single-site RI	A research infrastructure located in a unique place. (European Commission 2017)
Smart Specialisation Strategy	A place-based approach characterised by the identification of strategic areas for intervention based both on the analysis of the strengths and potential of the economy and on an Entrepreneurial Discovery Process (EDP) with wide stakeholder involvement. It is outward-looking and embraces a broad view of innovation including but certainly not limited to technology-driven approaches, supported by effective monitoring mechanisms (European Commission, S3 Platform).
User	Users of RI include individuals, teams and institutions from academia, business, industry and public services. They are engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of projects. Teams can include researchers, doctoral candidates, technical staff and students participating in research in the framework of their studies (European Commission 2016).

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ABBREVIATIONS

AC	Associated Countries
EC	European Commission
EJP	European Joint Programmes
ERA	European Research Area
ERIC	European Research Infrastructure Consortium
ESFRI	European Strategic Forum for Research Infrastructures
ESIF	European Structural Investment Funds
EU	European Union
FIRI Committee	Finnish Research Infrastructures Committee
IPSAS	International Public Sector Accounting Standards
IPR	Intellectual Property Right
JPI	Joint Programming Initiatives
KPI	Key performance indicator
MNC	Multi-national corporation
MS	Member States
NWO	Netherlands Organisation for Scientific Research
OECD	Organisation for Economic Co-operation and Development
R&D&I	Research, development and innovation
R&I	Research and innovation
RI	Research Infrastructure
RoI	Return on Investment
RIS3	Research and Innovation Smart Specialisation Strategies
RTD Framework Programme	EU Framework Programme for Research and Technological Development
SME	Small and medium enterprises
VAT	Value Added Tax

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INTRODUCTION

InRoad is a two-year Horizon 2020 project looking at ways to foster a **higher degree of coordination of priority setting, evaluation and funding mechanisms, as well as to ensure sustainable planning for Research Infrastructures (RI) in Europe**. To achieve this, the project conducted a broad consultation of national practices related to decision-making and funding for RI, and engaged in a series of interviews, case studies and workshops with regional and national stakeholders (national authorities, funding organisation, RI host institutions and RI managers) across Europe. The extensive data collected during the project activities allowed the project partners to identify a set of common trends and good practices that are briefly summed up in this document. The reports available on the project's website (see especially the InRoad Consultation Report, the InRoad Compendium and the report on the series of regional workshops) provide comprehensive background information. A series of further publications, based on in-depth case studies, are in preparation and will be released in the coming months. They will extensively discuss the elements provided in this briefing note and detail all the necessary information about the methodology used to collect the data and the questions addressed.

The needs, good practices and trends contained in this document allow InRoad to develop **policy insights for a broad range of stakeholders** such as EU and national policymakers, as well as RI funders and managers to contribute to a higher degree of coordination of RI policies in Europe. The document was elaborated based on the research activities conducted by InRoad consortium members. Therefore, please be aware that the document does not reflect the view of the beneficiaries but of the InRoad consortium, based on a thorough data collection process.

In total, **12 main policy insights** are presented in this document, which contain clear messages highlighting the main conclusions of InRoad findings. Most of the main policy insights are then developed as subsets of more concrete sub-recommendations, which are then further justified with explanatory texts containing complementary evidence from InRoad findings.

The findings and policy insights are allocated among the four following policy areas briefly described hereunder.

1. COORDINATION BETWEEN NATIONAL AND EUROPEAN RI ROADMAPPING PROCESSES

The InRoad Consultation Report and InRoad Compendium provide an overview of national RI roadmapping processes. The collected data revealed a great diversity of purposes and scopes of the national RI roadmaps in Europe. These differences between national processes result from the different national contexts and the specificities of each national Research and Innovation (R&I) system. Considering the diversity of national RI roadmapping processes in Europe and the fact that those processes respond to the specific characteristics and needs of national R&I systems, one-size-fits-all solutions are not possible. Hence, the following briefing puts forward a series of **key elements to be included in national RI roadmapping processes**, based on in-depth case studies, in order to respond to the needs of the different stakeholders.

2. EMBEDDING RI ROADMAP PROCESSES IN NATIONAL RESEARCH AND INNOVATION SYSTEMS

Decision-making and funding are essential aspects of national RI roadmapping processes. Aligning needs and decision-making on RI with national strategic priorities can help to successfully implement the national R&I strategy and achieve a greater socio-economic impact, as shown in the InRoad Consultation Report. This alignment supports a predictable

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environment for future investments and the long-term sustainability of RI within the national R&I system.

3. HIGHER DEGREE OF COORDINATION BETWEEN REGIONAL, NATIONAL AND EUROPEAN FUNDING FRAMEWORK

The results of the InRoad consultation shows that 93% of the responding countries link their RI funding decisions with the definition of strategic priorities, suggesting that this is perceived as an important aspect by the majority of consulted countries. In spite of this, funding from different sources (regional, national, European) along the different RI lifecycle phases – particularly for operation and termination - is not guaranteed in existing funding frameworks. A higher degree of coordination is therefore needed through **a better understanding of existing RI funding instruments and regulations across all RI lifecycle stages**. This is specifically the case for long-term oriented RI where a multi-source funding based model is necessary to ensure stability throughout all lifecycle stages, through the adoption of transparent and simple processes of application.

4. BEST PRACTICES AND COMMON STANDARDS FOR RI BUSINESS PLANNING

Finally, InRoad findings show that there is a common misconception that business plans are exclusive of the private sector. RI must use all possible means to **reach maturity and maximize impact to ensure their long-term sustainability**. In this context, a business plan is an important tool to support internal decision-making in RI. The respective policy area provides a set of recommendations for RI business planning.

Please not that this document is a preliminary draft and will be updated following the discussions with the RI stakeholder community at the InRoad Validation Workshop in Brussels on 01. and 02. October 2018. The Validation Workshop will allow the project to fine tune the following policy insights before the publication of a final report in December 2018.

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DETAILED ANALYSIS

COORDINATION BETWEEN NATIONAL AND EUROPEAN RI ROADMAPPING PROCESSES

IMPORTANT NEEDS IN VIEW OF NATIONAL RI ROADMAPPING PROCESS

In its report on RI roadmaps, the Organisation for Economic Cooperation and Development (OECD) defined RI roadmaps as "*Strategic plans elaborated jointly by scientists and policymakers, under the aegis of the latter, with well-defined explicitly-stated contexts, goals, procedures and outcomes. (…) Typically, it involves the organization of extensive "bottom-up" consultations, leading to tough choices among competing projects*." [1] The InRoad consultation revealed that the current situation in Europe is far more diverse than what in the scope of this definition. National RI roadmaps vary in scope, purpose and content type. Nevertheless, it is found that in most cases, a national RI roadmap is an important tool to assure transparency and increase the accountability of public research funding used for RI. The elaboration of a RI roadmap allows to bring together needs and priorities from the different actors of the national R&I system, taking into account both scientific excellence and societal impact. National RI roadmaps justify long-term funding commitments most effectively and efficiently and intend to avoid double funding. Finally, if a national RI roadmap has been elaborated in a transparent and fair process, it brings legitimacy to the process and the decisions among all relevant stakeholders.

TRENDS IN THE DEVELOPMENT OF NATIONAL RI ROADMAP PROCESSES

Since the foundation of the European Strategic Forum for Research Infrastructures (ESFRI) in 2002, national RI roadmapping processes have strongly evolved. Focusing solely on the ESFRI roadmap processes, their work can be roughly grouped in the following phases:

- The main intention of the ***1st phase*** can be understood as incubation of projects, incl. the first three ESFRI Roadmaps (2006), which are mainly lists of opportunities in form of 'wish-lists' of RI.
- The ***2nd phase***, which includes the ESFRI Roadmap 2006 and 2008, was marked by the request of the Council of the EU for more prioritization. Since then, the ESFRI Roadmap includes an assessment of the implementation of the projects and a prioritization of RI projects. ESFRI Roadmaps are based on integrated landscape analyses that identify not only needs and gaps in different thematic fields, but also cross-disciplinary issues. In this phase, also a High-Level Expert Group has been engaged by the European Commission (EC) to evaluate implementation status of projects on the ESFRI Roadmap. The AEG report[2] resulted in the introduction of new rules, such as a maximum of 10 years to be included as project on the ESFRI Roadmap. The projects then could reach the landmark status being included in the landscape if they fulfil specific minimal key requirements.
- The ***3rd phase*** of ESFRI Roadmap for RI introduced an ecosystem approach. The ESFRI Roadmap 2016 includes a landscape analysis, and the assessment of the implementation of the RI projects and the scientific case. The focus of the ESFRI Roadmap 2018 lies on the entire RI portfolio, and also includes – a periodic peer review of the scientific status of four landmarks as a case study. New guidelines provide precise definitions of RI, lifecycle, phases of the lifecycle.

[1] OECD Global Science Forum (2008): Report on Roadmapping of Large Research Infrastructures.

[2] European Commission (2013): Assessing the projects on the ESFRI roadmap: a high-level expert group report.

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- The ***4th phase*** will be characterized by the challenges lying ahead, e.g. the need to fine tune the methodology for monitoring RI projects and for the periodic review of landmarks. Further consolidation of the European RI landscape is needed in order to guarantee long-term sustainability of the European RI and ESFRI needs to find its role in the global context.

ESFRI has been a key driver of national RI roadmapping processes. Hence, trends towards more sound and complete RI evaluation and monitoring procedures, stronger prioritization and consideration of the existing European RI ecosystem can also be found at the national level, where the following steps are increasingly being taken into account:

- **Bottom-up approach** in order to elaborate the scientific needs of the national user community;
- **Landscape analyses** in order to assess gaps, strengths and priorities for RI within the national ecosystem and increasingly also in Europe;
- **Strategic planning** (top-down) in order to elaborate priorities and long-term strategies;
- **Evaluation methodologies** for the selection of RI proposal for the national roadmap and assessment of quality of existing RI;

In order to enhance the long-term sustainability of the RI ecosystem in Europe, the available public funding for RI needs to be invested most efficiently and effectively. A higher degree of coordination between regional, national and European RI roadmapping processes and also between relevant stakeholders is needed to identify needs and decide on priorities. At the same time, aspirations to enhance the adaptability of national RI roadmaps to supranational roadmaps need to acknowledge and respect the sovereignty of each country in setting their specific priorities for their national research policy. Therefore, full alignment of a national roadmap process is neither desired nor feasible, since the design of the national RI roadmaps results from the respective national R&I systems. InRoad findings show that any attempt to increase coordination between different levels requires taking into account the **specificities of national R&I systems**, as well as **opportunities for a higher degree of coordination at European level through transparent processes and public accountability**.

1 InRoad encourages the development of a common understanding of key elements in national roadmapping processes as a prerequisite for a higher degree of coordination for RI policy at national and EU level.

Considering the diversity of factors driving national RI roadmapping processes, the first step towards a higher degree of coordination would be the development of a common understanding of minimal sets of elements by elaborating and sharing **key features of a RI roadmapping process**.

BENCHMARK ELEMENTS FOR A NATIONAL RI ROADMAPPING PROCESS[3]

Based on the trends and the needs listed above, as well as on the data collected through the InRoad consultation and in-depth case studies, the following minimal elements are recommended as good practice for national RI roadmapping processes. A shared understanding of the different elements that compose the benchmark, may act as a pre-requisite for a higher degree of coordination of RI processes in Europe and lead to a more sustainable European Research Area (ERA). The following figure shows these different

[3] The benchmark elements for a national RI roadmapping process are further elaborated within Isabel K. Bolliger (forthcoming): National decision-making on prioritizing and funding of large-scale research infrastructures.

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elements that InRoad recommends as minimal elements of good practice. It shows in a dynamic way the different steps of the process and indicates when inputs from different actors are needed to support the prioritisation and quality of the process. Furthermore, it is important to note that this is a periodic process – although the appropriate cycle depends on the context.

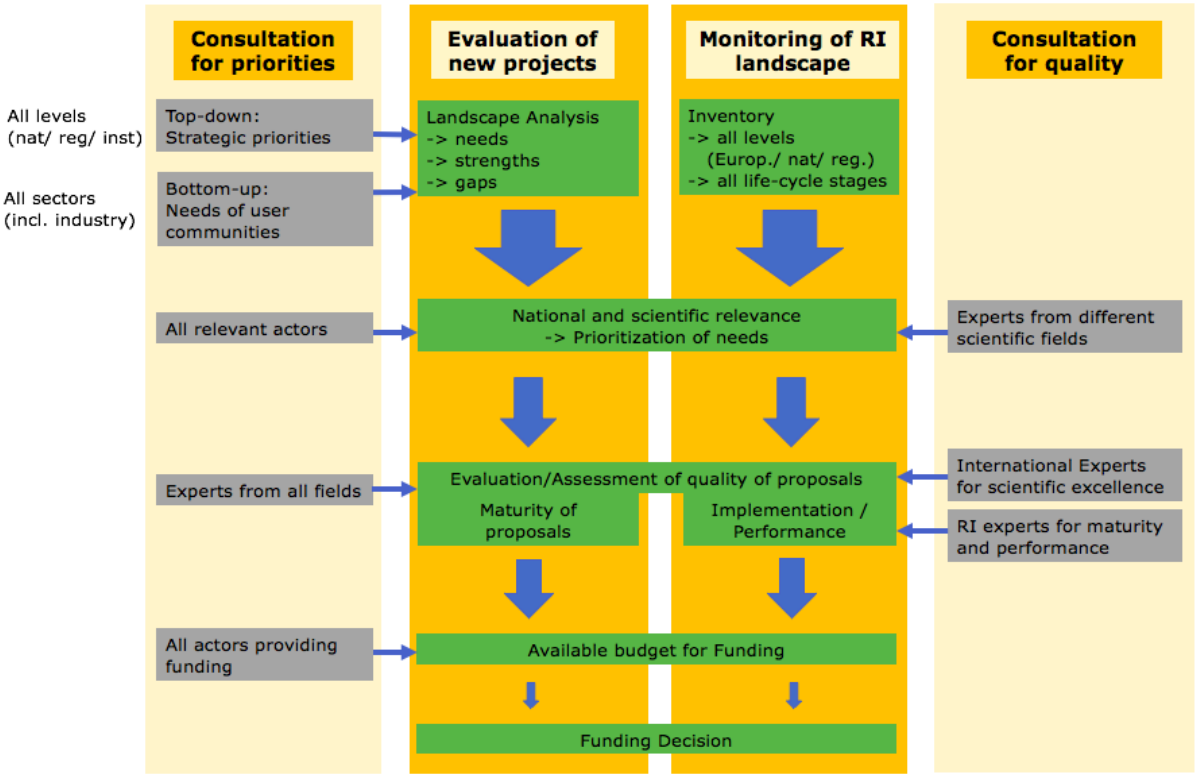

Figure 1: Elements of good practice for national RI roadmapping processes.[4]

1.1 National RI roadmapping processes include a regular update of inventories of existing RI and a bottom-up identification of needs for upgrades or new RI, i.e. through landscape analyses.

In order to invest available public funds for RI in the most effective and sustainable way, it is important to be aware of the existing national, regional and European RI landscape. This is the most relevant prerequisite to avoid duplications in RI funding. It is important that such inventories include RI at all levels and are updated regularly. A second relevant element is a regular landscape analysis. Appropriate identification of the needs of the user community ensures that investment in RI will be used to its full extent. The identification of strategic priorities of national relevance is important in view of decision-making and prioritisation.

1.2 National RI roadmapping processes include a transparent prioritisation of needs as well as long-term strategic priorities.

Transparent processes to assess needs and priorities are key to achieve a sustainable RI landscape. Therefore, all relevant actors benefit from defining their priorities, e.g. with institutional and regional roadmaps. Such processes may also support applications for the RI roadmap at national or European level. In view of prioritization, it is important to have a

[4] These elements of good practice of a national RI roadmapping process will be further elaborated within a PhD thesis of Isabel Bolliger. Isabel Bolliger (forthcoming): National decision-making for prioritizing of funding of large-scale Research Infrastructures.

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transparent, consultative process that includes all relevant stakeholders, including user communities, funders, operators and institutions hosting RI. A long-term vision is needed to consider the full cost of RI, including upgrades and eventual decommissioning. The national RI roadmapping process is important to reflect on both national and European priorities, assess the needs of the user community for RI on all levels and balance funding commitments for national RI and participation in European RI. The consideration of both levels is needed to better match existing and prioritised needs and available RI funding, and therefore increases the long-term sustainability of the European RI landscape.

1.3 National RI roadmapping processes include the evaluation of the relevance and quality of RI.

A third important element of a robust RI roadmapping process at national level is an independent and transparent peer-review process to assess the scientific quality and relevance, as well as the national relevance, uniqueness and maturity of RI proposals (see insight 2). The results are used to inform decision-makers and increase transparency and accountability within the process. The use of independent and international experts for the peer-review process is strongly recommended to avoid conflicts of interest.

2 InRoad recommends the use of a minimal set of common evaluation / monitoring criteria, which take into account scientific, managerial and strategic dimensions.

ELEMENTS OF GOOD PRACTICES FOR RI EVALUATION AND MONITORING

Any decision on prioritisation and funding of RI has to be based on transparent evaluation methodologies for the selection of RI for the national roadmap as well as for monitoring procedures, to guarantee accountable, transparent and sustainable funding for RI.

Based on existing good practices, InRoad recommends a minimal set of evaluation and monitoring criteria. A common understanding of these criteria between all relevant actors - decision-makers, evaluators, funders and applicants – is essential. The following minimal criteria are not to be seen as an exhaustive list, but as a common basis to develop methodologies and procedures that are adapted to each context.

Based on a review of national RI roadmapping processes in Europe, criteria that are commonly used in the evaluation can be classified into three broad categories:

1. **Scientific dimension**: collaboration and degree of internationalisation, strong user base, scientific and technological excellence of the RI, etc.
2. **Management dimension**: budget and operating costs, user policy, governance, open access and utilisation policy, sustainability, plan for decommissioning, etc. These elements are to be included in the business plan (see recommendation 10.3).
3. **Strategic dimension**: visibility, identified priority areas, socio-economic impacts and benefits, innovation potential, industrial relationships, etc.

InRoad recommends that evaluation methodologies take into account those three aspects and detail them into measurable indicators. For example, the ESFRI Roadmap Public Guide 2018 includes two annexes listing minimal requirements for both the scientific and implementation cases, which are used for its evaluation process[5].

Another important part of the RI roadmapping process is the monitoring of existing RI. Monitoring through periodic assessments of quality, relevance and other jointly elaborated criteria may also allow for corrective measures to be taken when needed, in order to maintain

[5] ESFRI, Public Roadmap 2018 Guide, December 2016, p. 22-23.

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the high standards expected from top-class RI. This information not only supports decision-making for individual RI included in the RI roadmap, but also the update or upgrade of the RI roadmap itself. The definition and use of a set of measurable, simple, relevant and reliable indicators could facilitate in a very significant way this monitoring process.

In order to enhance mutual understanding, InRoad also recommends to include visits to the facilities, interviews with RI managers and the possibility for the applicants in the evaluation and monitoring processes to react to the results.

2.1 InRoad suggests taking into account different lifecycle stages and type of RI (e.g. single-sited or distributed) in the evaluation and monitoring methodologies.

In many cases, RI are evaluated by the same methods and questions regardless of their lifecycle stage. This can lead to inappropriate or redundant questions in the evaluation process and limit the comparability of the results of the evaluation. Also, since the socio-economic impact varies across scientific fields and types of RI, monitoring is most accurate when it considers the mission of the RI. Monitoring cycles may differentiate between implementation and impact. When evaluating scientific and socio-economic impact, the evaluation cycles need to take into account that these impacts are often realized in the long- or very long-term. Furthermore, the scope and type of impact vary again across scientific fields and types of RI. From our analysis, it appears that **existing evaluation processes and questionnaires could be better adapted to the lifecycle, type and mission of the different RI**.

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EMBEDDING RI ROADMAPPING PROCESSES IN NATIONAL RESEARCH AND INNOVATION SYSTEMS

3 InRoad encourages better inclusion of RI roadmaps in the national research and innovation system and across other relevant national policies.

To the extent possible, engaging all key stakeholders providing funding for RI in the national roadmap process, e.g. ministries, research funding organisations or agencies, regions, host institutions (universities and other), is central to increase commitment and for strategic planning. This includes the planning of the national roadmapping process, definition of criteria and evaluation methodologies, and also decision-making on priorities and funding. **National RI roadmapping processes benefit from a bottom-up definition of the user communities' needs and a clear definition of priorities by funders and decision-makers based on various inputs**. The user communities include not only different scientific fields, but also other sectors such as industry and the public sector. Host institutions also have a key role in developing and maintaining RI, thus it is beneficial for them to develop their own inventories and priorities. Moreover, regional authorities managing European Structural Investment Funds (ESIF) could play a key role here linking regional, national and European systems through the development of Smart Specialisation Strategies. Finally, there are opportunities to make better use of the RI roadmap to link the represented scientific fields with relevant policy areas, e.g. medical research with health policy. This integration would support both strategic planning and prioritization, and contribute to the socio-economic impact of RI.

4 InRoad encourages user communities to increase their collaboration in the same and/or interdisciplinary thematic areas to prioritize their needs with a long-term perspective.

Due to limitations of available budget for RI and in order to generate synergies in the use of joint RI, **identifying common areas of interest and finding opportunities for increased collaboration within the existing landscape is advisable**. Some communities have longstanding experience in collaborating across borders and advocating for their RI needs in a more unified way (e.g. the particle physics community). It would be beneficial for other communities to adopt similar approaches and organize themselves into mono-disciplinary or interdisciplinary groups of common interest. This would enable researchers to exchange experience, share good practices, and identify common needs and priorities. In turn, this would help them form strong user communities as well as submit coherent RI project in national roadmaps and at European levels, thus using synergies and avoiding redundancies.

5 InRoad recommends to connect long-term RI funding considerations to the national RI roadmap.

Investments in new RI projects or upgrades need to be carefully evaluated and linked to national, regional and European RI strategic priorities, taking a long-term perspective into consideration. In order to guarantee the sustainability of RI on a roadmap, it is relevant that prioritised RI receive the national funding needed to be constructed, operated and upgraded, as well as finally terminated. This is particularly relevant to the adaptability to a pan-European or transnational RI roadmap (e.g. ESFRI).

More clarity in national RI roadmaps about the available funding commitments would allow better coordination for commonly financed RI at European level. In cases where RI included on the national RI roadmaps are primarily an input for funding decisions at a later stage (e.g.

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based on a competitive funding call), or serve to identify national scientific needs and existing gaps, there is a potential uncertainty for sustainable planning and coordination of RI at European level. Thus, **to ensure transparency and foster coordination between and across levels (regional, national, European), InRoad encourages the inclusion of long-term funding considerations in the national RI roadmap**, even when it does not include direct funding commitments.

5.1 InRoad recommends consideration of long-term funding needs for RI, including operation and eventually termination or reorientation/upgrade.

Most RI reach maturity after a few years of operation and must continue to be operated or renewed with public resources after the end of the initial funding period. Operational costs cannot always be covered solely by the budget of host institutions and additional sources of funding are often needed. Consequently, **InRoad advises that the sustainable long-term financing of these RI and additional operational and investment costs be considered already in the early planning stages** in order for new RI to plan and ensure their sustainable operation. Furthermore, costs for upgrade or – when relevant – repurposing or decommissioning can also be estimated in earlier stages, thus improving predictability and long-term planning.

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HIGHER DEGREE OF COORDINATION BETWEEN REGIONAL, NATIONAL AND EUROPEAN FUNDING FRAMEWORKS

The lifecycle of a RI is a reference to realistically understand the needs and targets of RI at a given time and at various levels. Funding dynamics, therefore, should be adapted accordingly to meet the requirements of the RI, safeguarding its long-term sustainability and securing at the same time effective and efficient spending. The richness of RI typology, the specific requirements based on the different RI lifecycles and organizational structure, and not least the relatively large financial resources required, result typically in very complex RI funding models. Timely planning, coordination and alignment of rules and procedures is therefore pivotal.

6 InRoad recommends using the lifecycle approach to contribute to the long-term sustainability of RI.

6.1 InRoad encourages EU Member States and Associated Countries to improve financial predictability and stability across the entire lifecycle of RI.

The diversity of available funding instruments during early stages (concept development, design, preparation and implementation) stands in contrast with the lack of suitable funding instruments for the operational phase. This leads to a shortage of adequate, realistic, and predictable funding mechanisms and models, necessary to cover the entire lifecycle. Unpredictability in political decision-making and budgetary fluctuations are identified not only as barriers for sustainable funding but also as risks to the well-functioning of international large-scale facilities. These two factors to be seriously considered in order for Europe to stay at the forefront of science and technology. Political consensus at regional, national and European level is needed to ensure the technological and scientific RI capabilities to face the increasing global competition. In light of this, securing basic funding for the initial period of the operational phase (even in cases where competitive funding later is assumed to be the major source of RI budget), and national contributions at a later point, would not only allow forward planning and timely preparation of RI, but also the recruitment and retention of human resources needed to operate these state-of-the-art facilities. Furthermore, although some RI are aware of these challenges and anticipate the need for predicting the costs for upgrading and even decommissioning, the InRoad case studies demonstrate that they rarely have a clear funding plan for it. Ultimately, **a combination of long-term strategic vision, followed by stable funding and greater commitment from national governments, agencies and institutions would help support these state-of-the-art facilities**.

6.2 InRoad stresses the need for a better integration of RI in their related ecosystems.

RI are intrinsically related to multi-level ecosystems, while taking part in shaping different scientific, socio-economic and societal dynamics. The services and products provided by these RI encourage cooperation between facilities and sharing of equipment, techniques and expertise across scientific communities, industry and others. In addition to bringing communities closer and sharing invaluable resources, RI can play a key role scaling-up research and development and innovation (R&D&I) capacities to create value for multiple ecosystem stakeholders. However, despite the increasing attention from policymakers and funders on the provision of RI services targeted at industry and broader society, RI — similarly to public universities and research institutions – work under restricted economic models, serving the extension of the knowledge base. Therefore, **although there is a declared impetus for RI to engage in industrial R&I activities, it remains important to be cautious about pressing incentives to produce positive short-term results, as scientific breakthroughs in certain disciplines might take decades to appear**.

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6.3 InRoad recommends strengthening the support to funding mechanisms for access to and coordination of facilities, notably the EU transnational access instrument.

As they engage in interactions with different stakeholder groups (i.e. scientific communities, public bodies, private companies and society at large), state-of-the-art RI play a pivotal role in the provision of services to user communities, even in areas where market failures exist. **Given this clear imperative to provide high quality and accessible RI services to a broad user community, InRoad recommends related costs to be considered part of the RI mission discussion from early stages on**. To this end, a transparent access and user policy based on different cost and funding models for individual user categories, such as academia and industry, would have to be developed.

Open (and transnational in particular) access policies have the potential to increase quality of services and extend availability to a broader range of users on a European and global scale. However, the rationalisation of third country access within RI funding models is sometimes challenging, especially when they are largely based on national contributions. As long-term sustainability of RI is highly dependent on the capabilities of user involvement, a clear definition and planning of open access funding is therefore crucial. In this context, it is recommended that **new and existing funding instruments take into account the diversity of user profiles and needs**.

Considering the expected tendency of rising open access to RI, as well as the goal of creating a true ERA, the defragmentation and optimisation of resources through common standards and harmonised access rules is vital. This, however, requires not just the establishment but also the **effective implementation of policies that ensure access to RI through the principles of transparency, non-discrimination, information and competition** (i.e. the European Charter of Access to RI). The high benefit of EU transnational access funding instruments in this context was singled out by representatives of the scientific community and of the RI in most of the InRoad workshops.

7 InRoad calls for closer synergies between regional, national and European funding frameworks to promote an integrated European Research Area.

Evidence shows that building pan-European RI requires a combination of regional, national and European Union funds that come from different types of funding instruments. The establishment and coordination of these funding instruments with national RI strategies is a long process that can take many years to materialize. In addition, expertise to coordinate different sets of funding instruments at the RI level appears to be lacking. Indeed, the suitability of those instruments varies depending on the type, scientific domain and lifecycle stage of the RI. These bottlenecks show that the coordination of RI funding instruments requires improvement. For this reason, closer synergies between regional, national and European funding streams are needed to maximize the impact of multilevel investments throughout the different stages of a RI lifecycle, whilst respecting the principle of variable geometry that accommodates differences between countries. It can therefore be concluded that a one-size fits all approach to RI funding fails to adequately recognize the needs and priorities of unique state-of-the-art facilities.

7.1 InRoad calls for greater coherence among the priority-setting tools within research and innovation policies across different levels.

RI roadmaps can be useful priority-setting tools to plan funding efficiently and to fulfil transnational strategic objectives. Besides this, there are other benefits that can be obtained

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from their use, which are yet to be found. For that to be possible, their use should be coherent and consistent with other existing regional, national and European policy and priority-setting tools. For example, as stressed on several occasions during the regional technical workshops, while national RI roadmaps are often perceived among RI managers as a valuable platform for strategic activities, sometimes national research, development (including sectorial) and innovation policies do not take them sufficiently into account. On the other hand, the possibility of going around the national commitments made, namely through projects funded outside of the RI roadmap, is seen by some workshop participants as a threat to the purpose of the roadmap and to the coherence of the overall long-term strategy. Considering the foregoing, **the success of RI priority setting exercises seems to be highly dependent on the ability to set in motion national long-term perspectives and commitments and on the embeddedness of RI roadmaps in the different national policies**.

The implementation of national policies in certain European countries is to a great extent dependent on ESIF (Cohesion Policy). The feedback obtained from regional workshops shows that the use and implementation of ESIF across regions is quite diverse. When it comes to distributed RI, the application process, the setting of objectives and their practical implementation represent some of the difficulties involved in the application of this instrument. On top of that, aligning regional policy with pan-European mission can also be challenging; while the latter looks at Europe as an assembly of Member States (MS), the former looks at Europe as a separate group of regions, leading to considerable consequences, such as divergent and misaligned objectives in the use of ESIF and RTD Framework Programmes. In view of this, where new measures are proposed, **further consideration should be given to identifying the differences and similarities between regional, national and European R&I policies** (namely, national research strategies, national roadmapping processes, ESFRI Roadmap).

7.2 InRoad recommends an adjustment of the funding regulatory frameworks across different levels to favour synergies between funding mechanisms.

The combination of different funding sources throughout the subsequent stages of a RI's lifecycle entails compliance with and coordination of different frameworks and sets of regulations across regional, national and European levels. Given existing differences between funding requirements of national budgets, EU RTD Framework Programmes for R&I and ESIF, a coordinated effort among MS, Associated Countries (AC) and the EC for **the simplification of rules would definitely help reduce the overall level of bureaucracy and financial uncertainty, and improve long-term organisational and strategic decision-making**. In particular, InRoad calls for the simplification and alignment of rules between ESIF (for R&I) and EU RTD Framework Programmes – or even the adoption of a common regulation – which would be welcomed by the RI community. The possibility of further alignment of rules should also be considered with respect to other funding sources for R&I, specially for forthcoming periods (e.g. InvestEU, EIB loans and others)."

In cases where the provision of national resources for operational costs is generally lacking, national commitments tend to be substituted with ESIF (even in pan-European RI). In consequence, the applicable financial regulations of ESIF can become an obstacle for some phases and the planning of future expenditures of the RI, as it is often the case with the coverage of running costs. **Ensuring a transitional period between implementation and operational phase that allows the funding of operational costs through ESIF** would contribute to bridging this gap. This holds particularly true in disciplines like data and High-Performance Computing, where systems become quickly obsolete and host organisations are under continuous pressure to cover expenses related to software, support and maintenance.

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Moreover, a common approach among the different countries and the EC is needed on issues that deeply affect the multilevel articulation that the European RI ecosystem demands. In-kind contributions, for example, represent an area in need of a common and defined methodology for collecting, reporting and accounting in-kind contributions of equipment and secondment of staff in international large-scale facilities.[6] Another example that illustrates this point as well is the Value Added Tax (VAT) /excise duty.

8 InRoad calls for fostering of mutual learning and cooperation through the exchange of information.

8.1 InRoad encourages further action to improve and facilitate sharing of practices and common development of funding solutions.

Considering the diversity of RI and of available RI funding instruments for their full lifecycle, it is commonly assumed that there is a need for a more efficient coordination of efforts in aligning the existing resources with the needs of each individual facility. As a precondition, this requires a shared understanding among all stakeholders (including funders), supported by a common terminology (e.g. research infrastructure, national RI roadmap, lifecycle approach, long-term sustainability, access policy, business planning, and so on). It has also been stressed that a complex bureaucratic environment tends to require people with highly specialised knowledge, even for mid-size projects, to fulfil all requirements.

Thus, while navigating the information on different funding schemes, some RI managers consider the possibility of having external help and training on how to apply for funding instruments, including those for interregional cooperation. Training workshops, among other discussion fora, are valuable contexts to promote the exchange of experiences and even to foster the common development of solutions.

8.2 InRoad stresses the importance of developing and adopting structured mechanisms to demonstrate, communicate and disseminate the scientific and strategic relevance of RI, as well as their broader societal impact.

As demonstrated through the case studies and Regional Technical Workshops, RI managers are aware of the present expectations to demonstrate their value after the recent and significant investments made. In this context, besides the need for a professionalization of managerial practices[7], the difficulty in **assessing RI impact calls for coordinated efforts to develop quantitative and qualitative models**. Indeed, specialized competencies are needed to assure the communication between the RI and their related ecosystems assuring that the scientific, socio-economic and societal value and the long-term return on investment of RI – understood as their value to the scientific community and broader public compared to their total costs – is transparent to everyone. Regarding the quantitative assessment, despite the need to adequate each RI key performance indicators to its mission, it would be mostly beneficial to **commonly agree on a minimal set of indicators allowing for benchmarking and international comparisons**.

[6] ERIC-ERIC Annual report 2017: https://www.ceric-eric.eu//wp-content/uploads/2018/06/CERIC-Report2017_spreadsDEF.pdf .

[7] See section 12 of this document.

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BEST PRACTICES AND COMMON STANDARDS FOR RI BUSINESS PLANNING

According to the InRoad consultation, two thirds of the respondents considered that business plans are needed and should be included in the eligibility conditions of RI roadmaps. Furthermore, the information gathered from the case study interviews reveals that business planning practices are diverse and challenging, but bring a considerable added value. As data on users, services, costs and budget change constantly, a sound business plan can facilitate continuous and periodic update and refinement. Therefore, **business plan is to be understood as a valuable management tool to reach RI's short- and long-term objectives, not as imposed requirement from funding organisations.**

9 InRoad advises that RI business plans address at least the following topics:

- Mission and objectives of RI;
- RI user strategy;
- Access policy and data management;
- Governance and management structure;
- Financial and funding framework;
- Stakeholder engagement strategy and communication;
- RI implementation plan and monitoring;
- Ethical and regulatory aspects.

A short and concise version of the business plan is a **relevant tool to align the RI's internal resources with its mission**. The use of specific, measurable, attainable, relevant and timely goals (SMART) is a transparent and effective way to improve performance and impact within a realistic timeframe. Regular revisions to the business plan provide an up-to-date framework for informed decision-making for RI operators and funders. Each of the stages of a RI lifecycle is linked to a distinct time frame with specific targets. In consequence, when drafting a business plan, it is important to distinguish short- and long-term strategic goals of the RI, as the inputs and expected outcomes will vary from phase to phase. Therefore, it is highly advisable for RI managers to apply both short-term and long-term thinking when drafting each of the chapters. This helps with predicting the periodicity of the update for each of the business plan chapters.

It is not optimal to impose a rigid template for RI managers to fill in. The business plan has to reflect the mission of the RI, the specificities of functioning in its environment, and the current political and economic situation. However, a well thought-out template may help RI managers contemplate the most important aspects of their strategy.

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Based on our case-study findings, InRoad recommends the inclusion of the following minimal components in a RI business plan:

Executive Summary	Description of the environment in which the RI will operate and external factors that are important for the achievement of RI goals (scientific, innovation and political context, PESTLE[8] analysis).
Mission and objectives of RI	Value proposition: specific benefits the RI will provide to users, to the ERA, to European or national policies and strategic priorities; Challenges addressed, gaps covered and socio-economic impact of RI.
RI user strategy	User segmentation and market outlook; Products and services offered; Training activities foreseen; User fees; User engagement and commercial policy.
Access policy and data management	Access modes; Data management plan; Intellectual Property Right (IPR) management.
RI governance and management	Legal framework and parties involved; Governance structure (e.g. steering board, scientific board, advisory committees); Management (e.g. mandate and responsibilities); Human Resources and talent development.
Financial and funding framework	Description of all present and estimated future income, including members financial and in-kind contributions, ESIF (if applicable), project funding, user fees and charities; Initial and planned investments; Cost breakdown per stage of development (construction, implementation, operation, upgrades). Costs should be preferably provided the format of annual estimations; Estimation of RI capital value. Estimation of the RI full annual cost or full lifecycle cost: this might be more applicable to the business plan of single-sited RI and central hub of distributed RI; Contingency plan, including reserved budget to cover the financial risks and mitigation strategies.
Stakeholder engagement strategy and communication	Stakeholder analysis and stakeholder engagement plan to attract and retain the interest of current and potential stakeholders of the RI; Communication plan, addressing benefits of RI activities for science and society.
RI implementation and monitoring	Activity plan and milestones (ERIC business plan should contain a description of common services. e.g. development of single access portal and databases); Internal performance monitoring (KPI and risk management plan); Liabilities including those associated to the maintenance of databases and repositories, even when the RI is no longer in operation.
Ethical and regulatory aspects	Ethical and regulatory aspects need to be elaborated.

[8] PESTLE refers to Political, Economic, Social, Scientific/Technological, Legal and Ethical factors that influence the business environment. PESTLE analysis is a widely used tool in management to assess the conditions and environment in which an organization operates. PESTLE factors are prime determinants of strategic planning and without them organizations might fail to achieve the desired goals.

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10 InRoad advises that all RI develop a business plan in order to align their strategy, resources and goals.

10.1 InRoad recommends early and continuous stakeholder involvement for the development, implementation and updating of a sound business plan.

The feedback obtained from some of the case study interviews shows that an early and continued active involvement of all stakeholders is vital for the RI's long-term sustainability. In particular, some respondents pointed out that the involvement of users and other relevant stakeholders in the conceptualisation of the business plan and in subsequent updates can be useful to provide feedback, direction and commitment for the development of the business plan and – most importantly – for the long-term sustainability of the RI.

10.2 For distributed RI, InRoad recommends that central hubs have a business plan, which serves a guiding framework for the business plans of the nodes to reflect coherent strategies.

To achieve a greater coordination and reduce defragmentation, it is important for all distributed RI (national RI, national nodes of international RI, as well as their central hubs) to have a business plan, and that they are interlinked. Feedback from the case studies participants shows that the **business plan** at the level of the RI is expected to serve as an overall framework for national procedures as well as for the central hub to steer the nodes in the same direction and ensure coherence across the whole distributed RI. Therefore, it is highly advisable that the **nodes' business plan reflect their specificities in a way that is coherent with the overall RI's business plan**, in order to sustain a common strategic view.

10.3 InRoad encourages funders and decision-makers to request business plans as part of application procedures for the national RI roadmap and for funding, and to include them in the evaluation criteria.

The requirement of a business plan for roadmap and funding applications will contribute to the awareness among the stakeholders involved that having a business plan is important in all stages of the RI lifecycle. Supporting measures should be considered for applicants to improve business plan preparation. For the assessment of business plans, funders and policymaking organisations are encouraged to ensure business planning expertise and RI management experience in their respective evaluation procedures.

10.4 InRoad recommends that business plans are used as a reference for the development of other more operational documents.

The feedback obtained from the case study interviews shows that RI's business plans are also used as a base for drafting documents such as Annual Work Programmes, Investment Plan, Data management Plan, Engagement Plan, the Access policy document, and others. A concise business plans can facilitate their use as management tools and serve as a regular updated reference base.

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11 InRoad recommends the use of business plans as a management tool, in the form of a living document aimed at ensuring the long-term sustainability of the RI.

Long-term sustainability is an issue that raises concern among RI managers. State-of-the-art research facilities not only require stable and predictable funding frameworks to excel, but also effective management systems in place to execute their strategy. One relevant point mentioned during the case study interviews is that while the widening of membership and strengthening of partner involvement are generally perceived as important for the long-term sustainability of the RI, **bringing added value to the user communities is fundamental**. In this respect, careful consideration should be given to the questions listed below when defining the mission and value proposition of the RI:

- Who is the RI serving?
- What do users need?
- How to engage with users?
- How to position RI services?

11.1 InRoad recommends that all RI use the business plan as a strategic tool to connect their mission with national and international strategic research agendas.

When designing the value proposition, RI are strongly encouraged take into account the relevant external developments, in particular the national strategic agendas for science and innovation in their research domain, in order to align with the policy level.

11.2 InRoad stresses the importance of short-term and long-term financial forecasting.

Despite the complexity in gathering annual and lifecycle cost data, the benefits and implications of such forecasting and performance management for RI should be further explored. One of the practices from our case studies show the requirement for roadmap applications to provide separate planning and estimates of cost and funding for the implementation phase and for a period of 10 years running and operating the RI. It remains to be seen whether a gradual move towards the collection of full annual costs for the entire RI (including nodes) could be achieved in the mid- to long-term.

Creating **an appropriate cost structure is vital for the RI's overall performance**, as it helps to clearly visualize the relationship between revenue and expenses during budgeting and planning. The feedback obtained from the case studies suggests that accounting practices among RI might differ considerably. At the majority of pan-European RI, the central hub's accounting information tends to be collected in accordance with the regulation of the host country, and at the node level, partner institutions follow their national auditing and accounting rules. However, there are cases in which a consensus among partnering countries has been reached to adopt a common international accounting framework. Given that the majority of users of accounting information and contributors to the financial sustainability of ERIC are European national funding agencies, the adoption of a universal set of accounting standards, such as the International Public Sector Accounting Standards (IPSAS) at the central level, would provide a more consistent framework among different ERIC and a **familiar system of accounting rules that can be used in different countries**. Furthermore, adjustments to the **risk management strategy** are necessary when transitioning from one phase to the other. To help navigate uncertainty and mitigate potential financial and managerial risks during both phases. Scenario building, KPI and milestones are helpful tools to set expectations and priorities, as well as monitoring progress in a transparent and factual way. Equally significant are **contingency plans**. The feedback obtained from the interviews reveals that not all RI have adequately protected themselves from an emergency scenario by setting aside a contingency budget. Although some of them have laid down in

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their statutes that in the event of financial risk a member's liability shall be limited to its respective yearly contribution, it is still unclear whether a member's annual financial contribution to an ERIC could be used to cover potential financial risks straightaway. The reason behind this is that public funds may be used only for the purpose(s) for which the MS or AC's parliament appropriated them. It is therefore advisable for the governing bodies of RI to discuss whether the establishment of an ex-ante financial provision, i.e. a credit reserve guarantee mechanism, is needed to cover any potential financial risks.

11.3 InRoad encourages using and periodically updating the business plan throughout the entire RI lifecycle.

It is important to remember that business plans are **living documents, thus reviewing them on a regular basis is useful to assess whether the RI strategy is still in line with the initial objectives**, or whether further adjustments are needed to meet them.

Successful engagement with existing and potential user communities is seen as a key factor to ensure its operational sustainability. A description of the potential user community during the Preparatory Phase is as important as performing an updated analysis of the user segments throughout the RI's lifecycle.

Other important elements of continuous business planning are monitoring mechanisms. These are not just vital to ensure a constant flow of information among all relevant parties, but also for greater organisational efficiency. KPI, when appropriately used, can be a valuable tool to help retain the focus on objectives and better understand the factors involved in the success or failure of their attainment. At the same time, relying on them a single measure of success can distort the way in which the RI performs and how it is perceived. Their use, therefore, should be combined with additional measures, such as regular meetings, periodic internal reports or feedback from external stakeholders. As calls for accountability and cost-effectiveness in the public-sector lead to the introduction of performance indicators, **using structured management approaches to report on processes and outputs becomes increasingly important for RI managers and funders**. A constant flow of information between the central hub and the national nodes on key accomplishments or unresolved issues helps prioritize tasks and coordinate resources more effectively. KPI developed centrally and adapted to meet specific node needs, offer a system to stay on top of operational progress. Understanding KPI and selecting those that are best suited to track performance is viewed as highly important by some of the interviewees. Furthermore, as funding for science in Europe comes under pressure to show what recent investments have returned, RI managers should strive to gather evidence on their output. This should not be seen as a threat to the RI but as an **opportunity to demonstrate the value that their services bring to science, the economy and society**. In particular, large-scale facilities with financial and in-kind contributions from various international shareholders have a duty to collect such metrics to help funders understand the Return on Investment (RoI). However, it should be noted that different RI might use different metrics in accordance with their type and scientific field.

12 InRoad calls for the professionalization of business plan drafting and implementation.

According to some case studies, a solid business and management expertise appears to be lacking in business plan drafting. There appears to be a need to improve the professionalization of administrative, financial and other strategic activities. When appropriate, the use of external services such as consultancies, management or communication specialists with a solid understanding of the needs of RI can help increase the quality of certain activities and improve RI visibility. Regarding business planning in particular, it is important that the consultants understand the specificities of research services and RI.

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12.1 InRoad encourages the development of human resources strategies to attract and retain personnel with financial and managerial experience.

Scientific and administrative professionals, with separate mandates ("double-headed management"), are of equal importance for running a RI. Indeed, RI need a balanced combination of both scientific managerial expertise, and they would benefit from having an administrative manager with a clear and strong mandate to lead the execution of the business plan and the RI's day to day management. To support this, funding organizations and host institutions at national and European level are advised to remove formal obstacles in their procedures to hire and retain professional managers for RI.

12.2 InRoad encourages the development of training schemes, the exchange of practices and mutual learning exercises for RI managers.

Our analysis shows that supporting measures for RI-managers at the national level as well as the European level (ERIC Network Forum) can facilitate the exchange of good practices. For instance, the organization of seminars and courses targeted at auditors and RI managers on the implications of the ERIC legal framework, particularly on issues such as VAT exemption, in-kind contributions, human resource policies and accounting practices in general, could help prevent future misunderstandings or cumbersome situations faced by RI managers.

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