ERIC Forum Implementation Project

Report and proposal for a model sustainability plan for ERICS

Work Package 4 - Deliverable 4.4

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Executive summary

Stakeholders supporting the realisation of the ESFRI RIs are more and more interested in instruments to frame and evaluate the return on their investment. A demonstration of the RI bankability may even be considered a prerequisite, by the RI potential members, before signing up to the establishment of an RI. For scientists called to manage an ESFRI RIs, completing a business plan and modelling the production of value for their RIs can be daunting, due to the peculiar system that the ESFRI RIs have set on, as well as to, potentially, the lack of either specific skills or instruments.

Through this exercise, we have designed an instrument for the analysis of the modus operandi and the qualitative evaluation of the sustainability perspectives of an ESFRI RI. This instrument is composed of a questionnaire and of a summary picture of the RI-operation model, which can be drawn from the questionnaire responses.

We have tested this instrument with the population of RIs involved in the ERIC Forum Implementation project. We have retrieved a general operation model outline for the RI population examined (number of respondents: 17), also discriminating results between Operation Phase RIs (N=12) and Implementation Phase RIs (N=5).

Analysing the "Input-process-output" system of the surveyed ERICs, we have retrieved an average ERIC *modus operandi* and sustainability model, with the following peculiarities:

- The RIs are characterised by a multidisciplinary team; this implies the availability of diverse resources and inter-linkages among different capacities, with the ability to approach a research questions from various perspectives; this can represent a great benefit for the entire organisation and for the overall output capacity of the ESFRI RI ecosystem.
- 94% of the RIs stakeholders are public while a few RIs have a certain proportion of private stakeholders, of which the most represented are private not for profit entities and Small-Medium Enterprises; the engagement of the private stakeholders appears to be more typical of the established RIs; this should be considered when monitoring and evaluating the RIs' development, that their full economic potential can only be delivered with the sufficient maturity of service and administrative practices.
- In the governance sphere, we detect that in all the RIs a strategic management board, a general director, and an internal scientific committee are typically established. Only 50% of the RIs responding to the survey have an advisory innovation committee that meets at least once a year; this trait may also be considered as becoming more prominent with the RI maturity, more fully realising their ability to support industrial and societal innovation.

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- The RI equipment is rarely leased, while it is typically either owned or otherwise availed of; service agreements between the ERIC and its nodes is a distinguished strategy for the ERIC sustainability.
- HRs are permanent employed for 63%, seconded for 26%, in kind for 27%. Staff retention is not a particular concern for the RIs and the temporary contracts are often utilised for the employment of personnel. The permanency of the staff, which is positively expressed in this population, is a sustainability feature for an organisation that has service provision as a main objective and activity: it offers some guarantees in terms of quality and continuity of service provision.
- In terms of the main activities carried out by the RIs, "service provision" is the most typical activity (with approximately 94%), articulated over access to data (80%) and training service (80%) and access to facilities (67%) and research services (67%); the second and third most typical activities are research and training (both at 69%), and, to a lesser extent, education (38%); The analysis of the relevance assigned to some key performance indicators does seem to only partly align with the stated objectives and activities: some revision of the attention dedicated to the analysis of the RI performance may be needed, as well as further investigation into this discrepancies.
- In the context of the output, we observe that most financially-evaluated output types are well expressed, and only some of these elements, such as spin-offs, are under-represented. Contract research and collaborative research are among the most used technology transfer pathways, followed by patents and licensing of the IP generated. The non-financially evaluated results, on the other hand, are always robustly present, and the most important output regards publications, project activities, and networking activities, which may include the training of graduate and postgraduate students through public research funds. The balance between these different outputs positively contributes to the RI sustainability and an evidence of its ability to deliver on its core essence as a European Research Infrastructure.

While the instrument is certainly perfectible in terms of analytical depth, it is, according to the personal feedback received, a valid propaedeutic instrument, especially for RIs in implementation phase or in the early stage of their operation phase, to approach the modelling of their modus operandi and support the identification of specific sustainability perspectives. Ultimately, the instrument provides an insight into the logic of the process that transforms the RI resources into products of value to the RI stakeholders. The questionnaire and figure template, respectively enclosed in Appendix One and Appendix Two of this deliverable, should be utilised as integral elements of a comprehensive medium-term business sustainability plan.

Resources allowing, the instrument will be improved with the automation of the summary figure creation, from the questionnaire responses. Further investigations would also be needed to discriminate whether the relevance of the indicators have a pattern in relation to some of the characteristics of the RIs, such as maturity or domain. The evaluation of the different

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contributions by the central and nodal part of the ERIC could also be developed, as part of a new investigation.

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Document log

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1	2022-05-09		Ilaria Nardello/ Eramaris

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List of abbreviations

ERIC	European Research Infrastructure Consortium
ESFRI	European Strategy Forum on Research Infrastructures
KPI	Key Performance Indicator
MKR	Minimum Key Requirement
RI	Research Infrastructure

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ERIC FORUM

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Background

Long-term sustainability of Research Infrastructures (RIs) was identified as a key policy priority by the Informal Competitiveness Council in July 2014. While RIs have been identified as critical elements of the EU competitiveness in the global knowledge-based economy, their sustainability is always under scrutiny by their main (public) stakeholders, in view of the relevant resources that are invested in their implementation, both at the national level as well as at the European Commission level. According to the European Strategy Forum Working Group (ESFRI; 2017)[1] on the Long-Term Sustainability of Research Infrastructures, a robust long-term vision, embedded in a supportive policy driven environment, is key for the successful implementation of a Research Infrastructure (RI). The European Investment Bank (EIB) defines sustainability of an RI as underpinned by the application of few main practices [2], such as: i) Ensuring strong governance, transparency and accountability, for the use of public funds; ii) Integrating high environmental, technical and social standards into business activities, by linking research to innovation outcomes; iii) Minimising risks and delivering results.

In this framework, business modelling and business planning are considered a useful instrument supporting the governance and the strategic management of any RI. The ERIC Forum Implementation project, with its task 4.4, has endeavoured to define a specific instrument to retrieve and analyse the modus operandi of the ESFRI RIs and support the planning of their sustainability.

As a preliminary step for the activities of T4.4 of the ERIC Forum Implementation project, a workshop[3] was organised, in collaboration with CERIC-ERIC and the Horizon2020 project ACCELERATE: "Planning for the Sustainability of Research Infrastructures", which was held on line, on the 25th of May 2021[4]. The event put to the fore the policy perspectives on RI sustainability issues and on planning instruments proposed by European projects, as well as examples from operational Research Infrastructures, to demonstrate various expectations, requirements and approaches in planning for the medium to long-term sustainability of the RIs. The concluding policy panel stressed the positions of the RIs in the wider European policy framework, and emphasised the relevance of planning for sustainability, at the RI strategic management level.

As a continuation from this introductory meeting, T4.4 went on to define a questionnaire for the description of the transformation process that turns the RI resources into value products, either economically tangible or intangible. The description of this process provides the basis to capture the model of the RI modus operandi, and to discern how each RI is performing against an ideal

[1] ESFRI Scripta Volume II Long-Term Sustainability of Research Infrastructures Author: European Strategy Forum on Research Infrastructures Long-Term Sustainability Working Group

[2] EIB: Antonella Calvia Goetz, "Sustainability Issues in funding research infrastructure", presentation at Symposium on European Funding Instruments for the development of Research Infrastructures, Madrid, 19 April 2016.

[3] https://www.eric-forum.eu/2021/06/02/overview-►-planning-for-sustainability-of-research-infrastructures/

[4] https://www.eric-forum.eu/event/planning-for-sustainability-of-research-infrastructures/

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(balanced) RI, where the nature of the stakeholders is both public and private, the fields of activities are rather multidisciplinary, the governance is established and articulated in various bodies, the human resources for the RI operation are reliably in place, access policies are defined and where both economic and non-economic output are represented, and a number of innovation pathways are activated.

Considering the ESFRI RIs, and the particular boundary conditions of their environment, which is far removed from the commercial universe, we shall refer to this model as the ***RI modus operandi and sustainability model***.

The results presented in this report shall serve as a basis for an educational approach to structuring the RI operations, led by the living examples of established ERICs. It is envisaged that this methodological approach will promote awareness in early-stage research infrastructure managers, who may be in need of guidance in organising the complexity of an operational RI and who may use this instrument to demonstrate the process of value creation within their organisation, for the benefit of their stakeholders.

This instrument may be most useful for the RIs transitioning from the Implementation to the Operation phase, when the management of the RI may be in need of supportive instruments, also integrating already existing approaches and instruments, to demonstrate the value and bankability of their RI.

Credits

This work is authored by Dr. Ilaria Nardello, with the expert voluntary contributions of Prof. Francesca Magli (Università di Milano Bicocca) and Prof. Carlo Rizzuto (CERIC-ERIC), for which the author is most grateful. We wish to also acknowledge the Executive Masters in Management of Research Infrastructure, at Università di Milano Bicocca, which provided the framework to initiate this work, in 2019. We also are extremely grateful to all the respondents who put time and effort towards providing the quality information, which was required to test this instrument and establish a benchmark.

Methodology

In our modelling approach, we considered initially two main methodologies: i) the Canvas business model (Osterwarder et al., 2010a), which allows for a static representation of the various elements of business operation for commercial organisations; and: ii) the ToolTechNova® (Devillez et al. 2014) modelling instrument, which is a user-friendly methodology that captures the dynamic nature of the value generation. At the end of this selection and analysis process, we decide for the creation of an instrument more similar and with

the same logic as ToolTechNova®. This instrument is fit to describe the operations of technological core facilities, to which research infrastructures can be, albeit not entirely, assimilated. While the reference model Tool Tech Nova is protected by copyright and it was not possible to obtain a license, we retained the experimented approach, tested in previous projects (Sharebiotech).

Drawing from the existing approaches and from ESFRI documentation, as well as from the personal experience of the authors and contributors of this deliverable, we developed an RI-specific questionnaire (Appendix 1), to describe the RI "input-process-output" transformation process for value creation. This questionnaire and the colour-coded summary picture (a template is provided in Appendix 2) are envisaged to be used as an element of integration to a comprehensive business plan.

The instrument has been tested with the ESFRI RIs from the project consortium through an online survey, launched in August 2022, which stayed open until October 2002, targeted at the project partners, as well as other ESFRI-landscape RIs. The results of this survey were then analysed to exemplify the average characteristics of the modus operandi and the sustainability outline model of the European Research Infrastructures.

Results: Elements of Sustainability Plans

We present the data gathered from the ERIC forum survey (2022), organised according to the simple business model structure “input-process-output”. The survey was responded by 17 ERICs (of which, two were anonymous):

N	Name
1	ACTRIS
2	BBMRI
3	CERIC-ERIC
4	CLARIN ERIC
5	DARIAH ERIC
6	ECCSEL ERIC
7	ECRIN-ERIC
8	EMPHASIS
9	EPOS ERIC
10	EU-OPENSCREEN
11	Euro-Argo ERIC

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12	European Research Infrastructure for Heritage Science
13	European Spallation Source
14	LifeWatch ERIC
15	LOFAR
16	No name provided
17	No name provided

Table 1 – List of respondents (name and ESFRI domain)

General Observations

Respondent RIs were created between 2006 and 2016. One only is single sited, while all the others are distributed. Most are public organizations (87,5%) while 12,5% are private organisations, 6% are public-private partnerships (the remainder proportion was "don't know/cannot answer"). With the exception of Data, Computing and Digital RI (DIGIT), all the ESFRI domains are represented in the responses received: five RIs in the domain "Environment" (ENV); four RIs in the "Health and Food" domain (H&F); 3 RIs in "Physical Sciences & Engineering" (PHYS); 3 "Social & Cultural Innovation" (SCI); one in the Energy domain (ENE).

At inception, RIs were mainly focused on research and service provision for basic scientific research users (with percentages above 70%), with 59% also had education as a primary goal and only half of them (53%) were providing services for applied-research users. The main objectives of the monitored RIs only slightly changed over time: coming to the present days, service provision increased: in particular, two thirds (71%) of the RIs are dedicated to service provision for applied/commercial research user. This is likely depending on the maturity of the infrastructure that develops service provision. Also, novel objectives (other) emerged in recent times, such as: providing data and products for scientific users, related to the construction of the RI, as well as building/developing the RI facilities.

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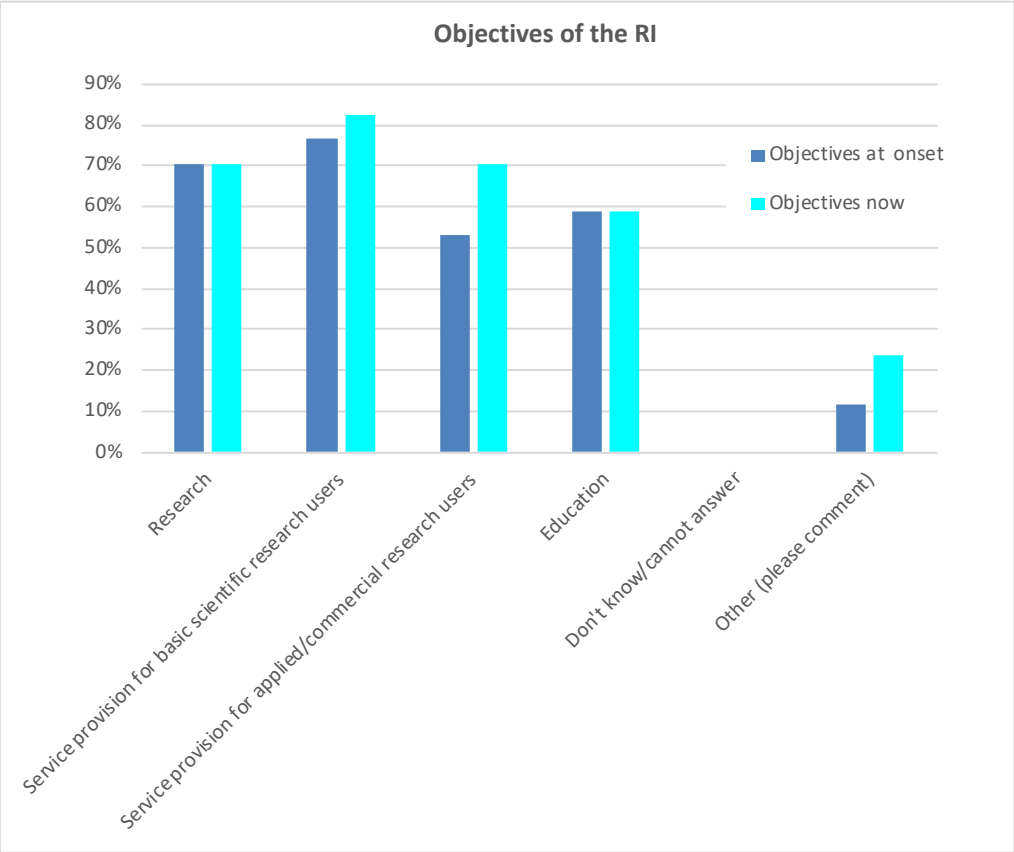

Figure 1 – Differences in the main objectives of the RIs, at the onset (in dark blue) and at present (light blue), showing that service provision is a prominent objective that becomes more prominent with the maturity of the RI, especially towards industry users; education and research are stable objectives.

With reference to the ESFRI definition of the RI lifecycle5, the respondent RIs were rather mature, with 71% of them being in the operational phase, and 30% in implementation phase.
The RIs in implementation phase are typically not established as a legal entity yet, and often still are in the process of defining their headquarters, key managerial staff and management practices, while they have fully aware of the relevance of multidisciplinary research approach and have established their catalogue of services, while they are progressing with the consolidation of their user community, the user strategy, the approval of an access policy and the establishment of an open innovation culture (fig. 1).

[5] http://roadmap2018.esfri.eu/strategy-report/the-esfri-methodology/

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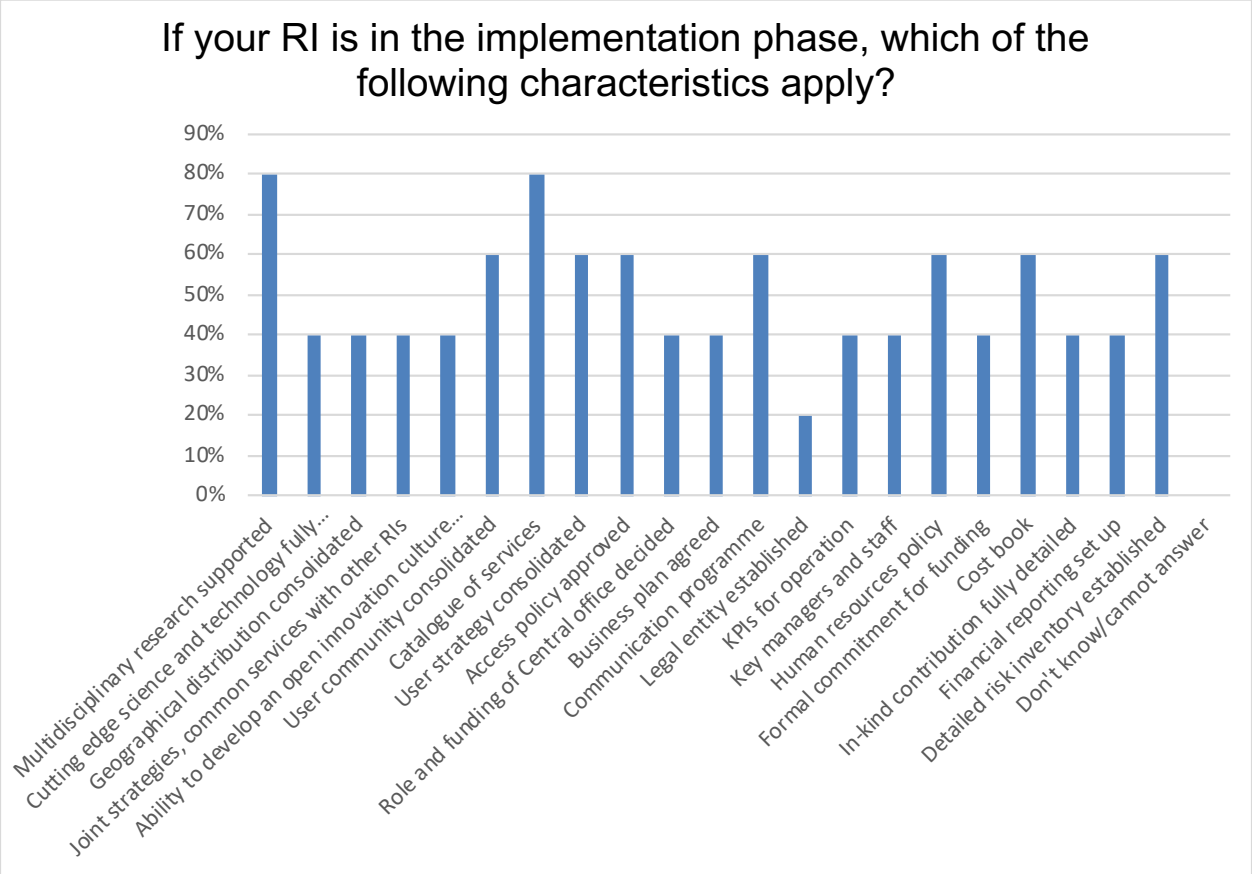

Figure 2 - Implementation phase – characteristics listed according to the ESFRI life-cycle assessment methodology (ESFRI, 2021).

The RIs in operational phase (fig. 2) have reached a consolidated identity, with management teams and practices in place, supported by a budget contributed by all the partners, while still working on increasing the budget for operations, establishing service agreements for access provision, expanding their geographical distribution and their ability to penetrate the scientific and technological boundaries of their domains. Multidisciplinary frontiers remain a challenge, as the involvement of users from the private sector.

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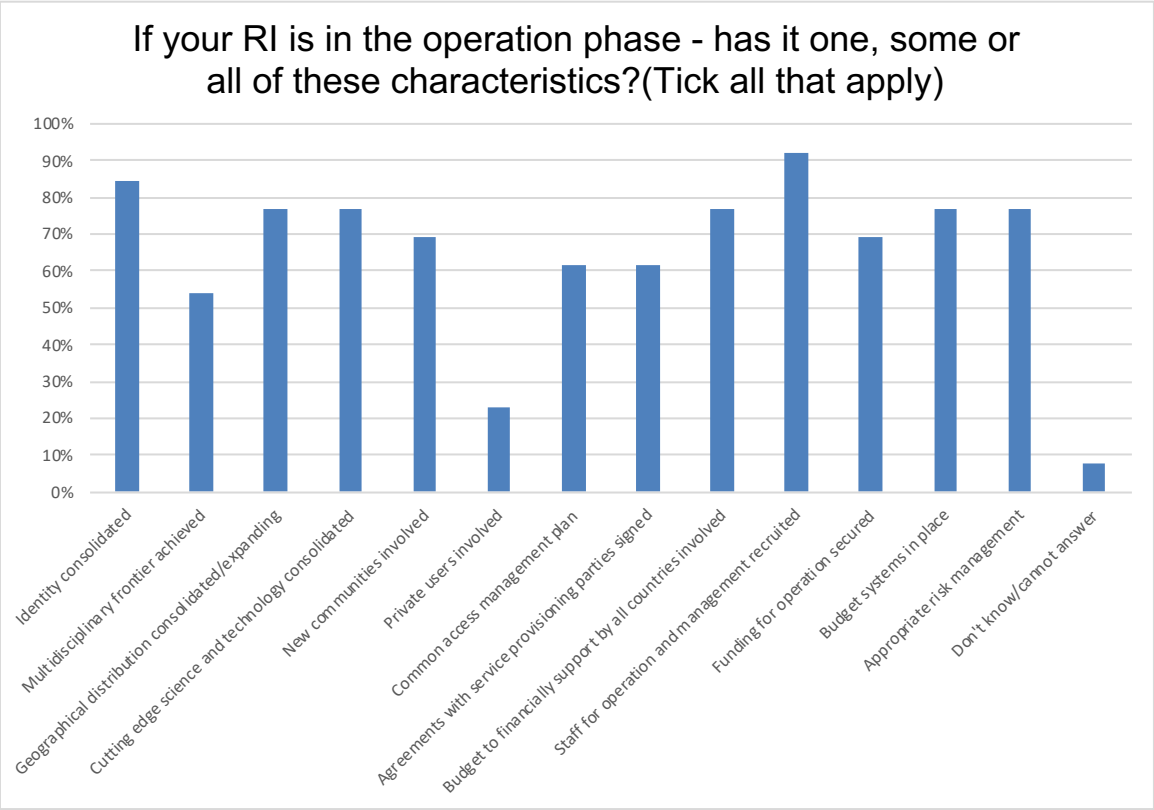

Figure 2 - Operational phase - characteristics listed according to ESFRI methodology of life cycle assessment (ESFRI, 2021)

The RIs were asked to rank their objectives at the onset and at present (Fig.3). Service provision for basic scientific research resulted the most popular, both at the start (82%) and at present (76%), followed by research (60%) and education activities (59%). The provision of services for applied research or commercial uses increases from 53% to 71%, in the period between onset and present times, showing that this objective becomes more relevant with the RI maturity. These results demonstrate the RIs' need and ability to strengthen their sustainability perspectives with time, by providing services for a fee to commercial users, as well as a different RI capacity to serve this type of users, with the RI maturity. The ability of the RIs to be an instrument of innovation shall therefore be expected, in a medium to long term perspective. The relevance of the objectives aimed at research and education is large and stable over time, demonstrating the peculiar nature of these organisations, which is different from a pure service provider, like a technological core facility or a Technology Infrastructure may be.

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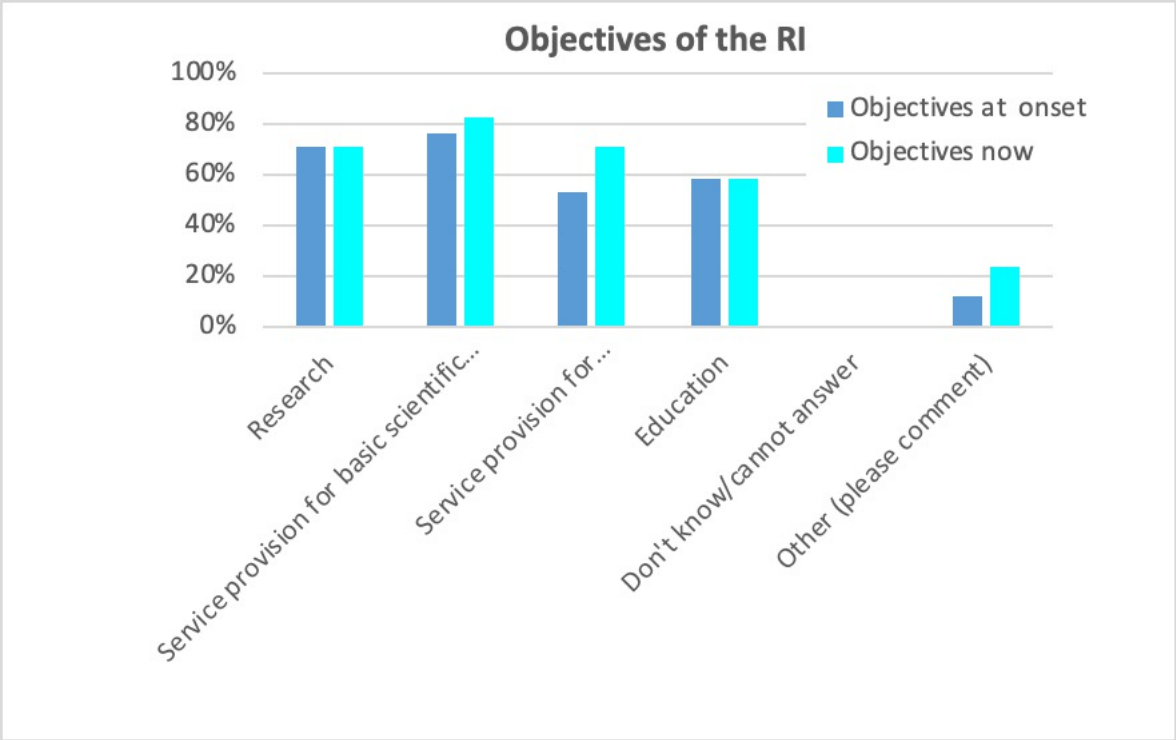

Figure 3 – Objectives of the RI, at the onset and at present.

Input

The resources that the RIs are inputting into the value-creation process are evaluated in terms of i) quality of the research teams, ii) economic resources, and iii) stakeholders:

The quality of the research teams

The quality of the research team is related to the RI scientific investigation capacity, where being multidisciplinary is likely a success factor, linked to the ability to rapidly react to new challenges and face complex scientific issues, as well as an ability to cater for different users. The results show that this is most frequent situation (81%), while two of the surveyed RIs are monodisciplinary (data not shown);

The economic resources

The economic input show a typical diversity in the annual budget composition (Fig. 4), regardless of the (predefined) budget size brackets (€0-2M; €2-5M; €5-10M; >€10M), where the budget items were ranked in terms of relevance as: member monetary contributions (37%), in-kind membership contributions (31%), EC grants: 25%,

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national/regional grants:17%), access fees from either public or private users (< 5%), and private donations (<3%).

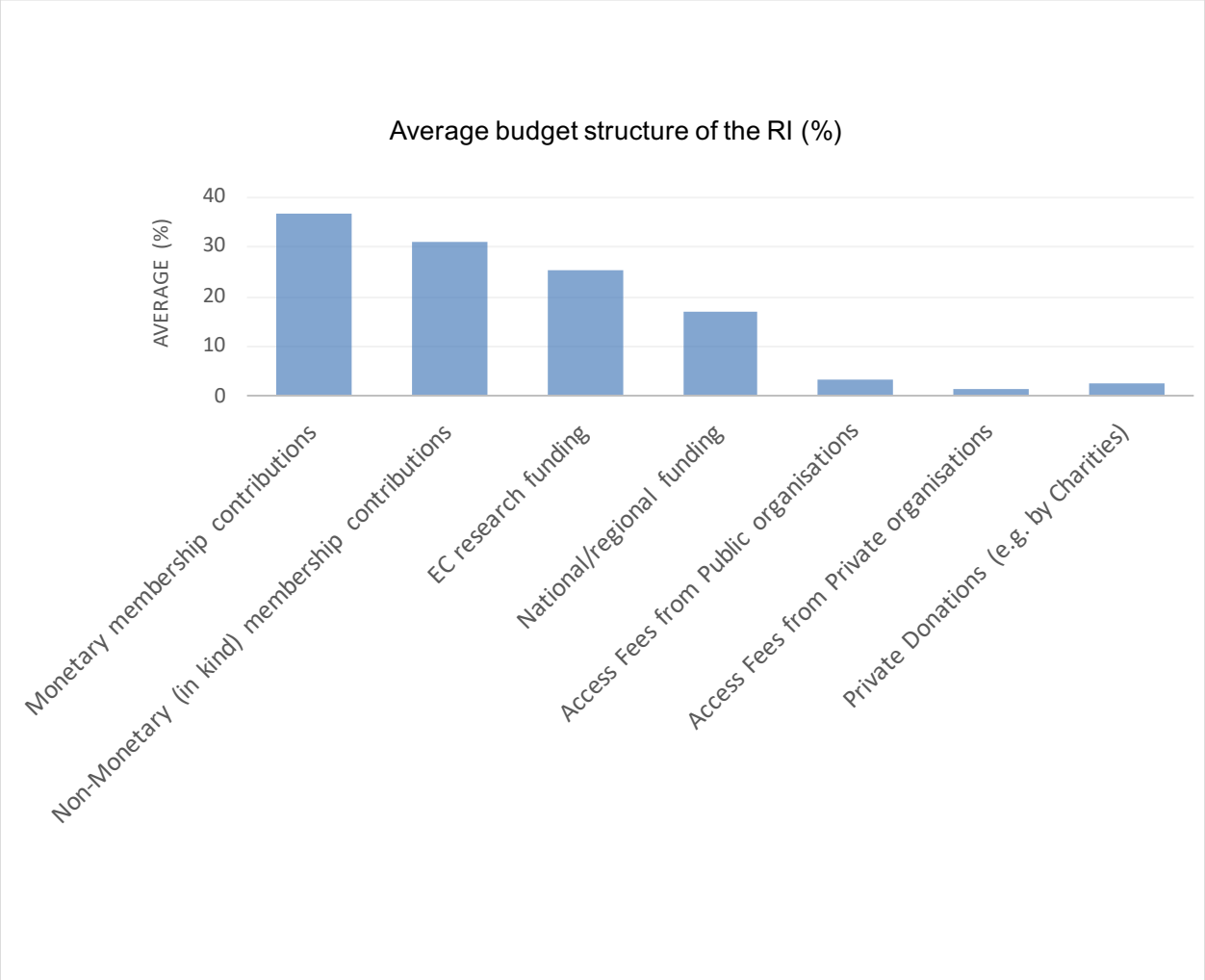

Figure 4 - Budget structure

The main stakeholders

The stakeholders of the respondent RIs are by a large extent (>85%) public, in particular representing national and/or EU level interests; private stakeholders are also

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represented, even if with much lower percentages; in particular: small and medium enterprises and not for profit organizations (about 43%)

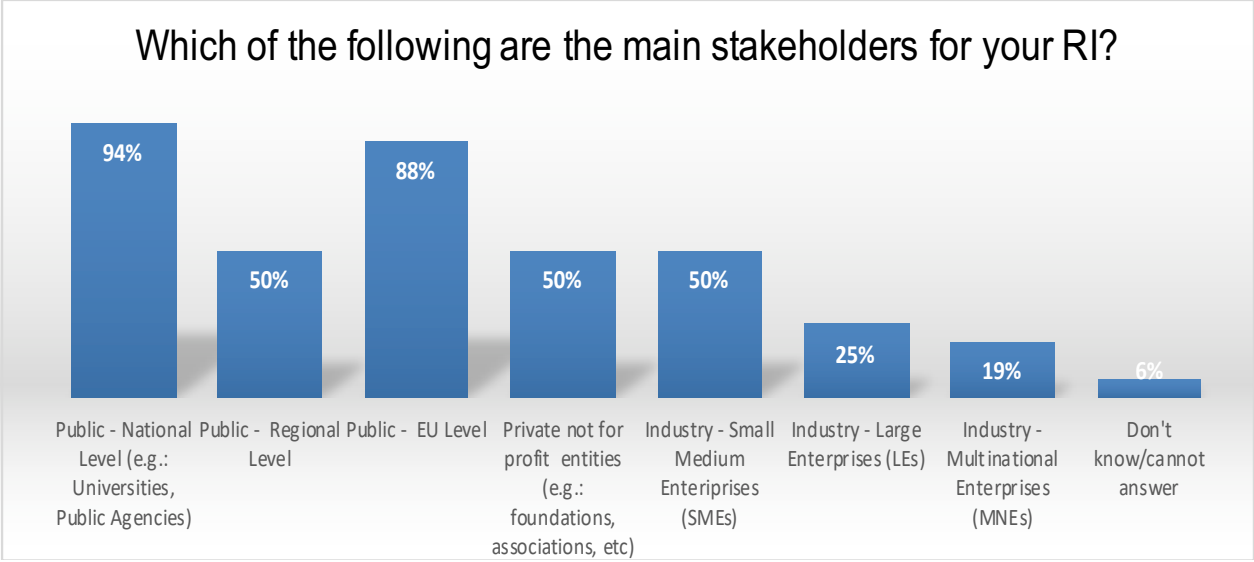

Figure 5 - RI stakeholders

Process

Governance

The results (data not shown) related to the implementation of a governance structure reflect the maturity of the population examined, mostly RIs in the Operation phase: in all RIs a management board is established, with a general director in place (three RIs declare that this is "planned to be implemented"), and with an internal scientific committee. Only 50% of the RIs responding to the survey have an advisory committee that meets at least once a year (tab. 2). Most of the RIs (87,5%) are guided by a strategic development planning document, updated every three or five years; a minority, 12,5%, do not have such a guide.

Answer Choices	Responses	
Yes, regular meetings, at least once a year	43,75%	7
Yes, meetings are scheduled ad hoc	6,25%	1
Not yet, but planned	18,75%	3
Other (please specify)	31,25%	5
	Answered	16

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Table 2- Advisory committee

Cost structure

On cost structure (Fig. 6.), the data indicate that: slightly more than 40% on average of the budget is spent on human resource (HR); in kind HR for the 28,5% (personnel employed at any RI-Member's institutions, providing services to the RI in lieu of monetary contributions); 22% on average are indirect costs (all expenses incurred for materials, services and maintenance necessary for the operation of the business); and: 15% are other direct costs (for example: depreciation costs or leasing fee of equipment; purchase of consumable materials; supply of services - catering, translations and interpreting, rent meeting rooms, cost of external auditor, support services; missions of structured and non-structured personnel, specific costs such as TNA and clinical studies).

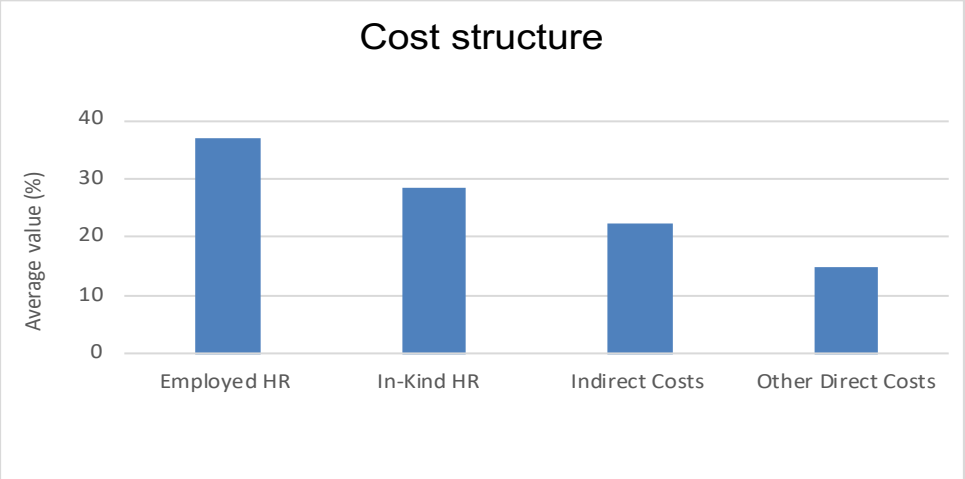

Figure 6 - RI cost structure

Capacity: Human Resources

Directly employed are 63% of the workforce while in-kind personnel are 27%. Seconded are 26% and dedicated to the Ri by a service agreement are 11% (fig. 7). This capacity is strongly related to sustainability, both in terms of ability to manage its own resources as well as in the ability to offer a stable environment for the RI operation and to users. The ability to directly employ personnel is largely demonstrated in the sample population.

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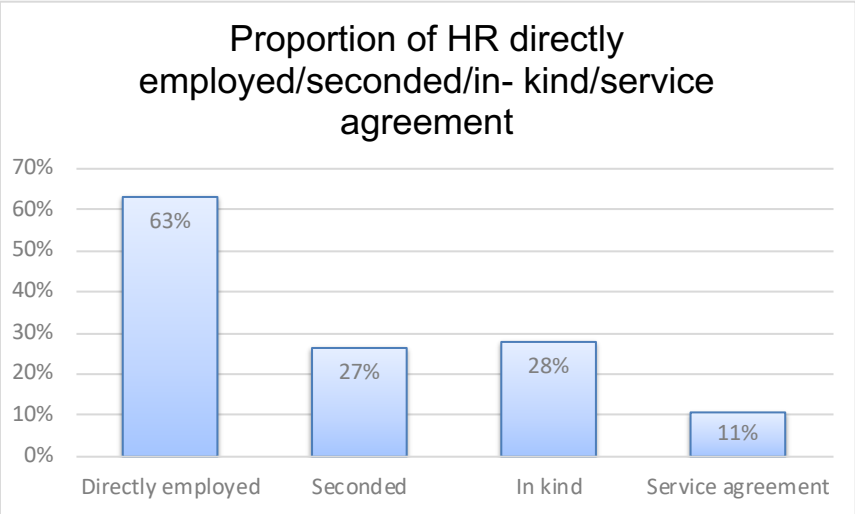

Figure 7a - proportion of HR directly employed, seconded, provided in-kind or through a service agreement.

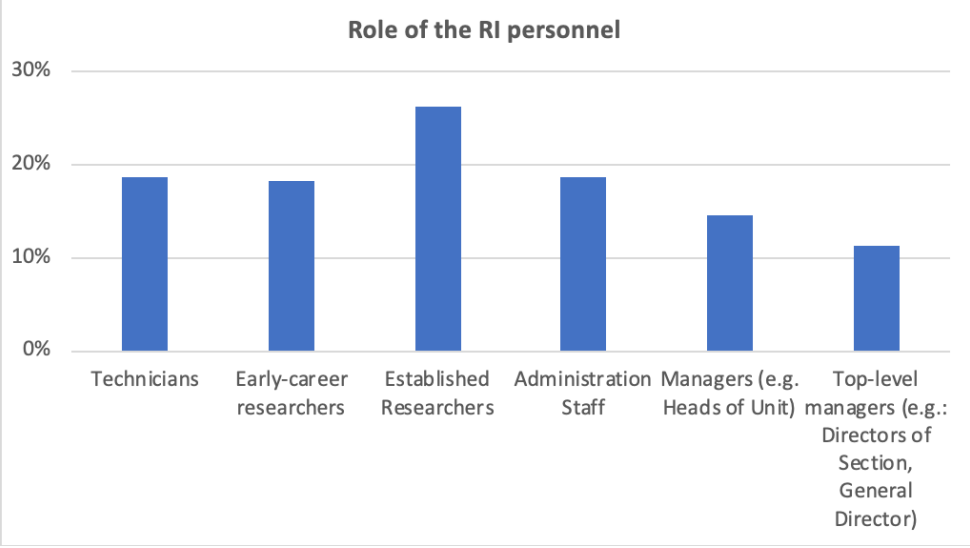

Figure 7b – Role of the personnel in the organisation

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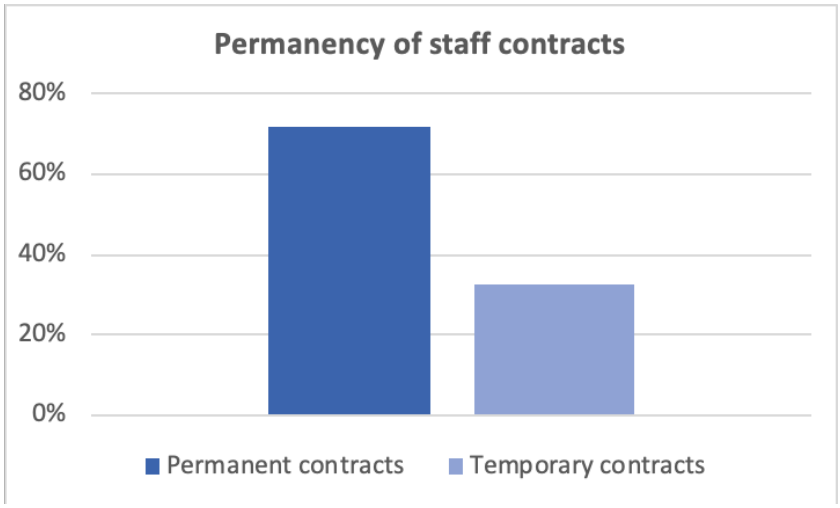

Figure 7c – Permanency of personnel contracts in the organisation

Capacity: Infrastructure and Equipment

The Infrastructure is maintained through public funding and in 50% of the cases all the equipment is owned (Tab. 3); only in one case, part (30%) of equipment is leased; in the other case, the respondents provided "other" as an answer, without further detail. This aspect deserves further investigations, as similar surveys (AssemblePlus project) more typically reported that all equipment is owned, in the case of public research centres, or leased for Technological Core Facilities (Sharebiotech project). What lies behind "other" may reflect on the nature of the RI organisation of resources, which, especially in distributed RIs, where the equipment and the facilities may not be centrally owned by the ERIC but rather provided in kind or through a service agreement. In this respect, the ESFRI RIs have nailed a sustainability feature which highly enhance their competitiveness.

Respondent ID	Owned (%)	Leased (%)	Other (%)
1	100		
2			100
3	100		
4			100
5			100
6	100		
7	100		
8			100
9	100		

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10			100
11	100		
12	100		
13			100
14			100
15	100		
16	30	30	40

Table 3 - Percentage of the RI major scientific equipment which is owned or leased with the respect to the total that is in use?

Main Activities and research programmes

In terms of the main activities carried out by the RIs, it is surprising that the "service provision" is an activity performed by almost all respondents (94%), followed by research projects and then by training activities in almost 70% of the respondents. Education is less frequently represented - 37% of the cases (tab. 4 and fig. 8). However, this confirms the ability of the RISs within the ESFRI and ERIC paths to identify priorities in terms of sustainability and maintenance of long-term performance

Activity type	**Frequency**	**N**
Service provision	93,75%	15
Research projects	68,75%	11
Education	37,50%	6
Training	68,75%	11
Don't know/cannot answer	0,00%	0

Table 4 - Main activities of the RIs

Figure 8 - Main activities of the RIs

Key performance indicators (KPIs)

The most important performance indicator for RIs (Fig.9) are units of access with a percentage of 67% respondents ranking this indicator as a top priority. In second place is the quality/SOPs, which half of the respondents indicate as either high (27%) or medium (27%) priority; the number of research projects is either a high priority, for 27% of the respondents, or a medium priority (13%); publications are never described as a top priority but are ranked as a medium or high priority for half (27% and 20%, respectively) of the RIs; User satisfaction is more frequently described as either a low priority (27%) or a medium priority (20%), while it is a high or top

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priority in 20% of the cases; staff retention is top priority in only 7% of case, and one of the lowest priorities for 40% of the respondents; annual turnover was only described as a priority in 20% of the case, either as the lowest priority (13%) or the top priority (7%). In a much lower position in terms of priority are publications and annual turnover; intellectual property (IP) is mentioned as a KPI only in 33% of the cases and assigned a low relevance. It appears contradictory to place a large emphasis on units of access and disregard performance in terms of user satisfaction, perhaps based on the attention provided to quality of services and SOPs: user feedback is one of the greatest insights that any activity can utilise to evaluate its sustainability and we would recommend a higher attention to this aspect. Also, it is interesting to see that organisations based on scientific excellence are not driven by publications records or research projects. Here, it could be worth assessing why this is the case with a follow up questionnaire, also investigating whether the essence of these RIs is fully deployed. The lack of attention to the annual turnover is an indication that these organisations are not worried about economic sustainability in terms of mere economic value and that the value they generate is rather encapsulated by the amount of access they can provide to their user community. Further investigations would also be needed to discriminate whether the relevance of this indicator has a pattern in relation to some of the characteristics of the RIs, such as maturity or domain.

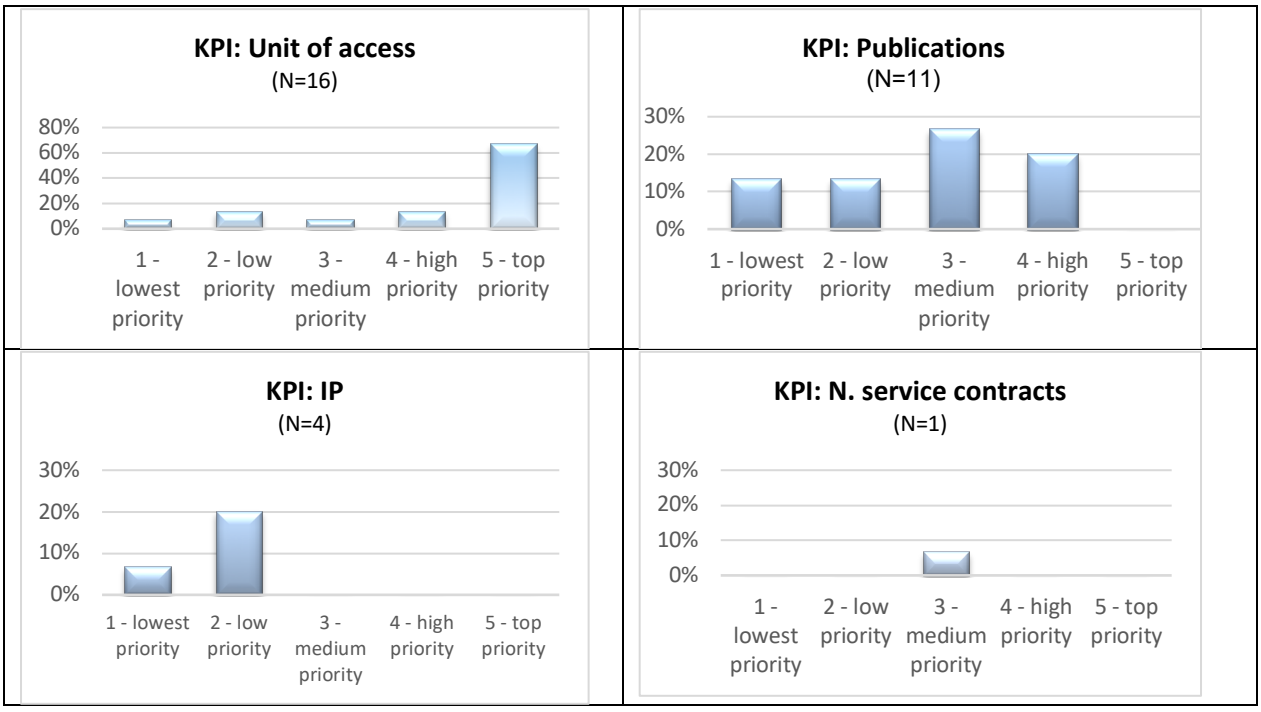

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Figure 9 - Key performance indicators (KPIs)

Output

Non-Financially evaluated products

As for the other non-financially evaluated products, the main questions concerned the publication quantity (160 peer reviewed publications on average, with a peak of 1300 and a

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minimum of 0) and quality (56% of the publications are peer reviewed); the data quality and openness data / metadata available; and on the availability of the RI facilities to students for training and for RI services (35 on average with a peak of 103). A winning strategy for the RIs, in terms of capturing this value, is to be acknowledged in scientific publications/reports, when results are obtained through the use of the RI (fig.10), however only 67% of the RIs adopt this strategy (Fig 10).

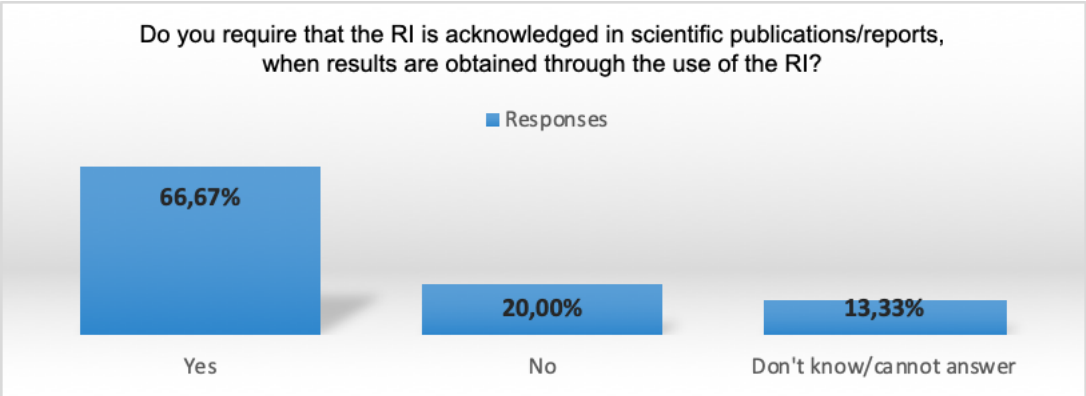

Figure 10 – scientific publications and RIs

Financially evaluated products

Service Offer, technology transfer pathways and marketing strategy

The most popular financially evaluated products/services in RIs are training (80%), data (80%), access to facilities (73%), research services (67%) and consultancy (53%) (fig. 11).

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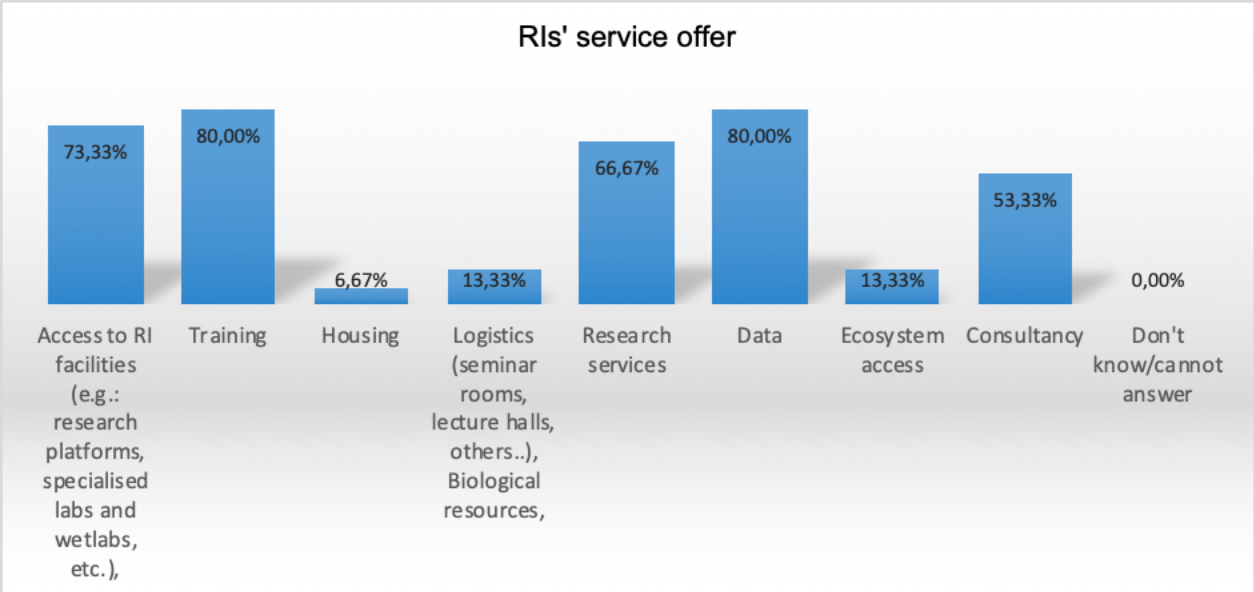

Figure 11 - RI services

Even if RIs generate IPs for 62% against 31%, it appears that contract research and collaborative research followed by patents and licensing are among the most used tech/knowledge-transfer pathways (fig. 12)

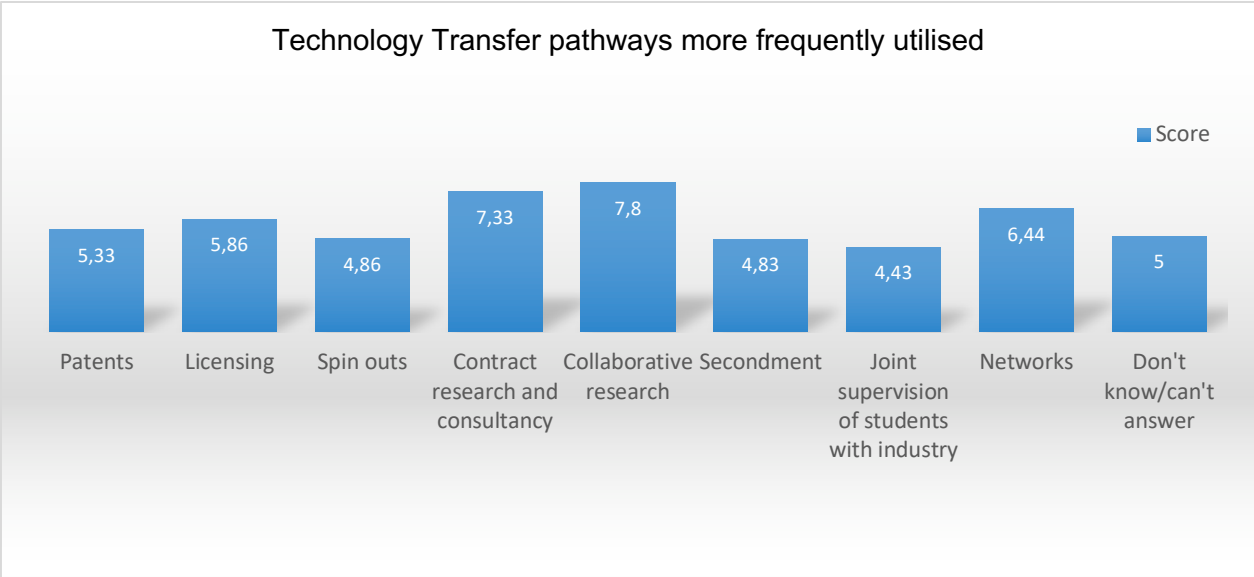

Figure 12 - Technology transfer pathways

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In term of marketing strategy, the services are offered by 40% of the RIs through a booking system while for 53% not; the rest do not know/cannot answer. 40% of RIs have a transparent pricing policy for the services offered, 13% do not have it and 47% do not know it.

Analytical considerations

Average modus operandi and sustainability model of the RIs

Analysing the "Input-process-output" system of the surveyed ERICs we observed that on average the model has the following peculiarities:

- The RIs are characterised by a multidisciplinary team which implies the availability of different resources and inter-linkages among different capacities, with the ability to approach a research questions from different perspectives. This can represent a great benefit for the entire organisation and for the overall output capacity of the ESFRI RI ecosystem.
- 94% of the RIs stakeholders are public while a few RIs have a certain proportion of private stakeholders, of which the most represented (50%), are private not for profit entity and Small-Medium Enterprises;
- In the governance sphere, we detect that in all the RIs there a strategic management board, a general director, and an internal scientific committee are typically established. Only 50% of the RIs responding to the survey have an advisory committee that meets at least once a year;
- The RI equipment is partly owned and partly in use through service agreements; rarely, the equipment is leased.
- HRs are permanent employed for 63%, seconded for 26%, in kind for 27%. Staff retention is not a particular concern for the RIs and the temporary contracts are often utilised for the employment of personnel.
- In terms of the main activities carried out by the RIs, "service provision" is the most typical activity (with approximately 94%), articulated over access to data (80%) and training service (80%) and access to facilities (67%) and research services (67%); the second and third most typical activities are research and training (both at 69%), and, to a lesser extent, education (38%)
- In the context of the output, we observe that most financially-evaluated output types are well expressed, and only some of these elements, such as spin-offs, are under-represented. Contract research and collaborative research are among the most used technology transfer pathways, followed by patents and licensing of the IP generated. The non-financially evaluated results, on the other hand, are always robustly present, and the most important output regards publications and networking activities, which may include the training of graduate and postgraduate students through public research funds.

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We have inserted all these elements in the RI business model representation of Fig. 13, which allows for an easy to share representation of the various elements of the RI sustainability model and their average level of expression in the sampled population.

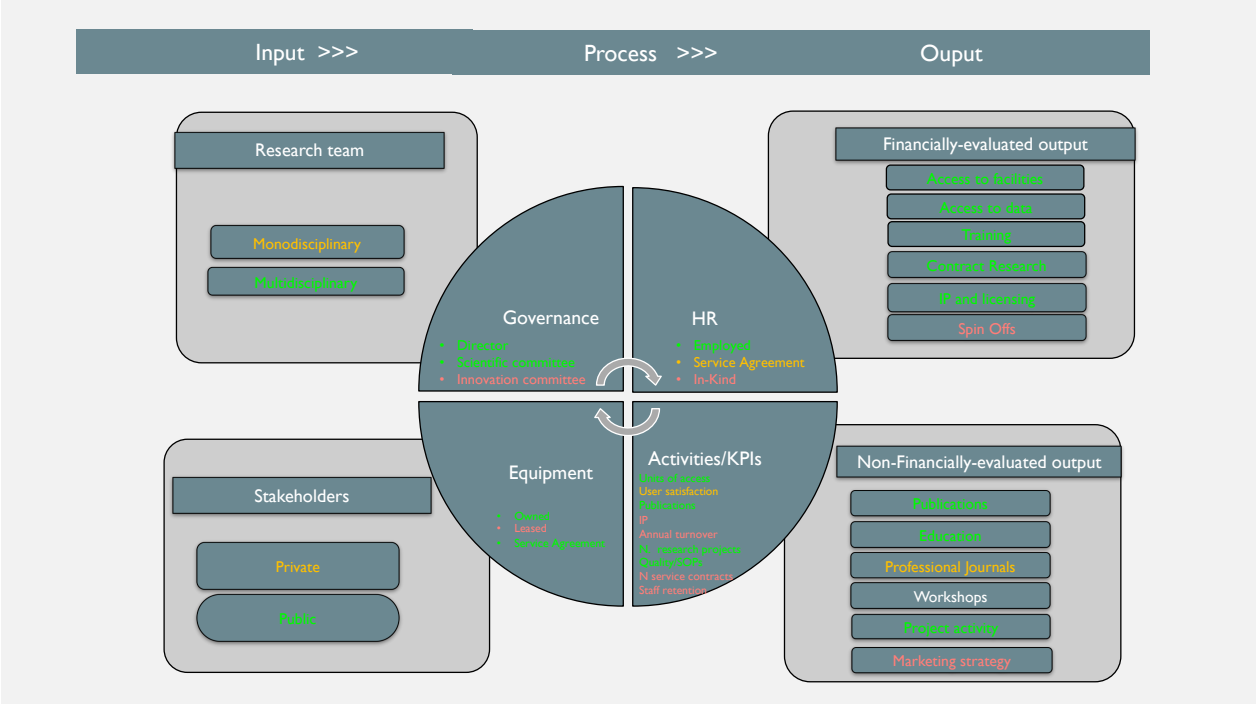

Figure 13 – RIs' average modus operandi and sustainability model. This scheme highlights the dimensions of an ERIC sustainability model. The colours of the various elements indicate the average level of expression of each element in the sampled population (green: the element is positively expressed; orange: the element is partly expressed; red: the element is marginally or not-at-all expressed;).

Conclusions

Through this exercise, we have designed an instrument for the qualitative analysis of the modus operandi and sustainability perspective of an ESFRI RI. We have adapted this instrument from a previous exercise in the context of the H2020 AssemblePlus project. We have tested this new questionnaire design with a survey of 17 RIs on the ESFRI roadmap 2021, of which five in implementation phase, from all the ESFRI domains but DIGIT, and mainly distributed RIs. While the instrument may still lack some analytical depth to fully interpret the varied landscape of the ESFRI RIs, it appears as a valid ally to gain a perspective into the modus operandi of an RI and

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provide an easy instrument to approach the logic of the process that transforms resources into products of value.

The questionnaire and figure template, enclosed in Appendix One and Appendix Two, respectively, can be utilised as supportive elements of a more comprehensive RI business plan.

Stakeholders supporting the realisation of the ESFRI RIs are more and more savvy of the need of management instruments to frame and evaluate the RI bankability, and will be asking for clear demonstrations before signing up to the establishment of the RI. For scientists called to manage an RIs, completing a business plan and modelling the business activity of their RIs can be a daunting process. With this work we are hoping to provide a useful instrument to approach this endeavour and a powerful stakeholder-engagement instrument.

Next Steps

Resources allowing, the instrument will be improved with the automation of the summary figure creation, from the questionnaire responses. Some developers have been identified that can support this improvement.
Further investigations would also be needed to discriminate whether the relevance of the indicators have a pattern in relation to some of the characteristics of the RIs, such as maturity or domain.
The respondents were asked to report facts and figures corresponding to the central ERIC administration and to avoid considering the dimension of their nodes, for example when referring to budget size, personnel types and relations, etc. It however common knowledge that the node dimension contributes largely to the whole RI operation. The evaluation of the different contributions by the central and nodal part of the ERIC is certainly much needed and could be of guidance to the stakeholders and RI governance. Funding permitting, this aspect also could be developed.

References

- European Strategy Forum on Research Infrastructures (ESFRI), Long-Term Sustainability Working Group, Long-Term Sustainability of Research Infrastructures, ESFRI Scripta Volume II, 2017
- European Strategy Forum on Research Infrastructures (ESFRI), Roadmap 2021 - Public guide, 25 September 2019
- https://www.eric-forum.eu/event/planning-for-sustainability-of-research-infrastructures/
- http://roadmap2018.esfri.eu/strategy-report/the-esfri-methodology/

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- http://roadmap2018.esfri.eu/projects-and-landmarks/
- https://www.esfri.eu/sites/default/files/ESFRI_Roadmap2021_Public_Guide_Public.pdf

Appendix 1 - The RI Modus Operandi and Sustainability Outline Model Questionnaire

The survey is articulated in four main blocks including:

- General data (the questions in this section can be omitted in case of self-assessment)
- Input
- Process
- Output
  - Economically evaluated output
  - Non-Economically evaluated output

For disambiguation of terminology in this questionnaire, please refer to:

- http://roadmap2018.esfri.eu/strategy-report/the-esfri-methodology/
- http://roadmap2018.esfri.eu/projects-and-landmarks/
- https://www.esfri.eu/sites/default/files/ESFRI_Roadmap2021_Public_Guide_Public.pdf

For further information, please, contact: ilaria.nardello@gmail.com

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General Data (This section can be omitted in case of self-assement)

1. What is the name of the infrastructure?

2. What type of RI is this?
   - Single sited
   - Distributed
   - E-infrastructure
   - Don't know/cannot answer
   - Other, please explain (free text)

3. What is the scientific domain of your RI?
   - Energy Environment
   - Health & Food
   - Physical Sciences & Engineering
   - Social & Cultural Innovation
   - Data, Computing and Digital Research Infrastructures
   - Don’t know/cannot answer

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4. At what point in the lifecycle is your research infrastructure?(Please refer to: https://www.esfri.eu/sites/default/files/ESFRI_Roadmap2021_Public_Guide_Public.pdf)

- Design
- Preparation
- Implementation
- Operation
- Termination
- Don't know/cannot answer

5. If your RI is in the design phase, which of the following characteristics apply? (Tick all that apply)

- Long term programme defined
- Scientific community established
- Developed European user community
- Initiative in synergy with existing national or international facilities
- Communication network
- Letter of intent signed/agreements with partners
- Scientific leadership, project manager
- Staff profiles identified
- Budget available for design study
- Knowledge on financial, technological risks
- Don't know/cannot answer

5b. If your RI is in the preparatory phase, which of the following characteristics apply? (Tick all that apply)

- Vision and mission
- Feasibility tested
- Cutting edge science and technology
- Geographical distribution defined
- Positioning in the RI landscape defined
- Ability to attract businesses, industries, public services
- Scientific-user community identified
- Commercial-user community identified
- Services linked with scientific-user needs
- Services linked with commercial-user needs
- Access policy defined
- Inter-institutional and multilateral agreement with partners
- Feasibility study successfully completed

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- Plan for preparation and implementation
- Measurable and satisfactory KPIs
- Human resources policy
- Governance structure designed
- Financial commitment by lead/host country
- Clear and estimated costs In-kind contribution policy Don't know/cannot answer

5c. If your RI is in the implementation phase, which of the following characteristics apply? (Tick all that apply)

- Multidisciplinary research supported
- Cutting edge science and technology fully defined
- Geographical distribution consolidated
- Joint strategies, common services with other RIs
- Ability to develop an open innovation culture established
- User community consolidated
- Catalogue of services
- User strategy consolidated
- Access policy approved
- Role and funding of Central office decided
- Business plan agreed
- Communication programme
- Legal entity established
- KPIs for operation defined
- Key managers and staff
- Human resources policy
- Formal commitment for funding
- Cost book
- In-kind contribution fully detailed
- Financial reporting set up
- Detailed risk inventory established
- Don't know/cannot answer

5d. If your RI is in the operation phase - has it one, some or all of these characteristics?
(Tick all that apply)

- Identity consolidated Multidisciplinary frontier achieved
- Geographical distribution of members consolidated/expanding
- Cutting-edge of science and technology consolidated
- New user communities involved

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- Private users involved
- Common access management plan (?)
- Agreements with service providers signed
- Budget for financial support by all countries defined
- Staff for operation and management recruited
- Funding for operation secured
- Budget accounting in place
- Appropriate risk management
- Don't know/cannot answer

6. Year of inclusion of the RI as a Project on the ESFRI roadmap? (definition of "Project" according to: http://roadmap2018.esfri.eu/projects-and-landmarks/)

7. Year of the establishment of the RI as a legal entity in the form of an ERIC or other legal entity form (if applicable)?

8. Year of RI termination/dissolution?
[definition of RI termination: http://roadmap2018.esfri.eu/strategy-report/the-ESFRI-methodology/]

9. What were the main objectives/nature of this RI at the onset? (Tick all that apply)
- Research
- Service provision for basic scientific research users
- Service provision for applied/commercial research users
- Education
- Don't know/cannot answer
- Other (please comment)

10. What are the main objectives of this RI now? (Tick all that apply)
- Research
- Service provision for basic scientific research users
- Service provision for applied/commercial research users
- Education
- Don't know/cannot answer
- Other (please comment)

2.0 INPUT

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11. What is the nature of this RI? (Tick all that apply)

- Private Public
- Public-Private Partnership
- Don't know/cannot answer

12. What is the legal structure of this RI (Tick all that apply)
ERIC
National not for profit organization (e.g. Association, Foundation, other)
International not for profit organisation (e.g. Association, Foundation, other)
Don't know/cannot answer
Other, please specify

13. What is the RI Annual Budget, in millions of EUR? (including both monetary and non-monetary contributions)

14. What is the budget structure of this ERIC, in percentages? (Please, enter the numeric value without % sign. The choices need to add up to 100%)

- Monetary membership contributions
- Non-Monetary (in kind) membership contributions
- EC research funding
- Access Fees from Public organisations
- Access Fees from Private organisations
- Private Donations (e.g. by Charities)

15. What is the cost structure of this RI? (Please, enter a numeric value without % sign. The choices need to add up to 100%)

- Employed HR (cost of staff, including only employed personnel)
- In-Kind HR (cost of staff, including only personnel employed at any RI-Member's institutions and providing services to the RI in lieu of monetary contributions)
- Indirect Costs (all expenses incurred for materials, services and maintenance necessary for the operation of the business. Example of these can be the rents of the offices in which the company operates; utility costs (electricity, water, telephone, internet, heating); administrative costs; the costs of shared equipment.)
- Other Direct Costs (These are costs strictly related to the constructions of the ERIC. Examples are: purchase of equipment - depreciation or leasing fee; purchase of consumable materials; supply of services - catering, translations and interpreting, rent

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meeting rooms, cost of external auditor, support services; missions of structured and non-structured personnel, specific costs such as TNA.

16. Is this RI integrated into a wider (eco)system? (Tick all that apply)
    - A strategic forum of RIs
    - Science cluster
    - Industry Cluster
    - Thematic Network
    - University
    - EU partnership
    - Don't know/cannot answer
    - Other (please comment)

17. Are the RI internal research teams monodisciplinary or multidisciplinary?
    - Monodisciplinary
    - Multidisciplinary
    - Don't know/cannot answer

18. Which of the following are the main stakeholders for your RI? (Tick all that apply)
    - Public – National Level (e.g.: Universities, Public Agencies)
    - Public - Regional Level
    - Public - EU Level (EC)
    - Private not for profit entities (e.g.: foundations, associations, etc)
    - Industry – Small Medium Enteriprises (SMEs)
    - Industry - Large Enterprises (LEs)
    - Industry - Large Enterprises (MultiNational Enterprises - MNEs) Don't know/cannot answer

2.1 Governance

20. Does this RI have a dedicated Management Board?
    - Yes
    - No
    - Planned to be implemented
    - Don't know/cannot answer

21. Does this RI have a General Director ?
    - Yes

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- No
- Planned to be implemented
- Don't know/cannot answer

22. Does the RI have a dedicated internal Scientific Committee?
- Yes
- No
- Planned to be implemented
- Don't know/cannot answer

23.Does the RI have an Advisory Committee on Innovation/Applied Research/Industrial engagement?
- Yes, regular meetings, at least once a year
- Yes, meetings are scheduled ad hoc
- Not yet, but planned
- Other (please specify)

---

3. Process

3.1Governance

---

24. Does the RI have a strategic planning document?
- Yes
- No
- Don't know/cannot answer

25. Is access to the research infrastructure and its services regulated?
- Yes
- No
- Don't know/cannot answer

26. Does the RI have an in-house research programme?
- Yes
- No
- Don't know/cannot answer

27. How is the infrastructure maintained or upgraded? (Please rank the options provided)

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- Public Funding not applicable
- Private funding/donors not applicable
- Sharing infrastructures with other entities not applicable

28. What is the percentage of the RI major scientific equipment which is owned or leased with the respect to the total that is in use? Please insert a number (without the '%' sign), to represent a percentage; the total should sum up to 100
- Owned
- Leased
- Service Agreement

29. General comments on the Governance of this RI (Optional)

3.2 Management

30. How many Full Time Equivalent staff are working in the RI? (Enter a number)

31.What is the proportion of HR directly employed/seconded/in- kind/service agreement? (Please enter a numeric value without % sign. The choices need to add up to 100 [%], value between 0 and 100 must be entered in every row)
- Directly employed
- Seconded
- In kind
- Service agreement

32. What are the roles covered by the RI staff?
(Please enter a numeric value without % sign. The choices need to add up to 100 [%], value between 0 and 100 must be entered in every row)
- Technicians
- Early-career researchers
- Established Researchers
- Administration Staff
- Managers (e.g. Heads of Unit
- Top-level managers (e.g.: Directors of Section, General Director)

33. What is the percentage of staff employed on a permanent or temporary contract?

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(please insert a number, the various answer should sum up to 100)

- Permanent contracts:
- Temporary contracts

34. What is the percentage of the permanent staff's time exclusively dedicated to service provision for either internal or external users?

35. Did you create incentives for researchers involved in service-provision activities?

- Yes
- No
- Don't know/cannot answer Other (please specify)

36. How simple or difficult is it to hire/dismiss permanent personnel from this RI?
(Please, scale from 1 - very easy, to 5 - very difficult)
1 - Very easy; 2 – Easy; 3 Neither easy nor difficult; 4 - Difficult; 5 - Very difficult.

37. Does the RI generate IP?

- Yes
- No
- Don't know/cannot answer Other (please specify)

38. When the RI generates IP, is this IP typically protected?

- Yes
- No
- Don't know/cannot answer Other (please specify)

39. General comments on the Management of this RI (Optional)

3.3 Activities

42. What are the main activities of this RI?
(Please, tick all that apply)
Service provision Research projects Education Training
Don't know/cannot answer

43. Does the RI have an internal research programme?

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Yes No
Don't know/cannot answer

44. Please indicate the Technology Readiness Levels which the RI provides support for? (TLR - https://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018-2020/annexes/h2020-wp1820-annex-g-trl_en.pdf),
TRL 1-3 (basic research)
TRL 4-6 (R&D for feasibility studies and prototyping)
TRL 7-9 (R&D for commercialisation)
Don't know/cannot answer

45. Does the RI have a specific personnel unit for business development?

- Yes, less than 1 Full Time Equivalent
- Yes, equal of more than 1 Full Time Equivalent Not yet
- No and not even planned

46. Is the disciplinary area of this RI very specific?

- Yes
- No
- Don't know/cannot answer

47. General comments on this Section “Activities”
(Optional)

3.4 Monitoring

48. What are the top five Key Performance Indicators (KPIs) for this RI?
(please, rank in term of relevance, from 1- lowest priority to 5- top priority)

- Units of access
- User satisfaction
- Publications
- IP
- Annual turnover
- Number of research projects
- Quality/SOPs
- Number of service contracts
- Staff retention

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49. General comments on the Monitoring of this RI
(Optional)

3.5 Service Provision

50. Does the RI have a booking system for the services on offer?
Onsultancies?

- Yes
- No
- Don't know/cannot answer

51. How beneficial in terms of career perspective is it considered working in this RI?
(Rank from 1 - very little to 5 - very much)
1 - Very little 2 - Litlle 3 - Medium 4 - Much 5 - Very much

52. What services does this RI offer? (Tick all that apply)

- Access to RI facilities (e.g.: research platforms, specialised labs and wetlabs, etc.),
- Training
- Housing
- Logistics (seminar rooms, lecture halls, others..)
- Biological resource
- Research services
- Data
- Ecosystem access
- Consultancy
- Don't know/cannot answer

53. Does the RI have a transparent pricing policy for the service offer?
Yes; No; Don't know/cannot answer.

54. General comments on the Service Provision of this RI
(Optional)

4 OUTPUT

4.1 Financially-evaluated output

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55. Do you know the market price of the services offered by this RI?
- Yes; No; Don't know/cannot answer; Other (please specify)

56. Do you have a pricing strategy?
- Yes; No; Don't know/cannot answer; Other (please specify)

57. Do your prices vary depending on the user?
- Yes; No; Don't know/cannot answer; Other (please specify)

58. What is the cost model for the RI's service offer?
- Full Economic Cost
- Cost recovery
- Operation at a loss
- Don’t know/cannot answer
- Other (please specify)

59. Which of the following Technology Transfer pathways are more frequently utilised in this RI? (Please, rank in terms of most frequent pathways by dragging them towards the top)
- Patents
- Licensing
- Spin outs
- Contract research and consultancy
- Collaborative research
- Secondment
- Joint supervision of students with industry
- Networks
- Don't know/can't answer

60. Does the RI have dedicated staff for marketing and communication?
- Yes; No; Don't know/cannot answer

61. Is the RI open for external access?
- Yes; No: Don't know/cannot answer

62. If applicable, what is the nature of the RI external users. Please provide approximate percentage distribution.
- (Please enter values between 0 and 100 in every row; the choices need to add up to 100 [%], value between 0 and 100 must be entered in every row)

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- EU users from public sectors
- EU users from industry sectors
- International (non EU) users from either the public or industry sector
- Other
- Other type of external users, please specify:

64. If applicable, who are the RI private/non science users? (Please enter values between 0 and 100 in every row; the choices need to add up to 100 [%], value between 0 and 100 must be entered in every row)

- Micro/startups
- Small/Medium Enterprises (SMEs)
- Large Enterprises (LEs
- Multinational Enterprises (MNEs)

65. If applicable, where are the RI private users from? (Please enter % value. The choices need to add up to 100 [%], value between 0 and 100 must be entered in every row)

- Regional
- National
- EU
- International

66. Does the RI require a fee for the services offered?
Yes; No; Don't know/cannot answer; Other, please comment

68. General comments on the Economic Output of this RI
(Optional)

4.2 Non- financially evaluated output

69. Average yearly number of peer-reviewed publications, in the past three years

70. Average yearly number of peer-reviewed publications by external users acknowledging this RIS, in the past three years

71. Average yearly number of data/metadata sets which become available, in the last three years (Enter a number)

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72. Average early number of conferences where results obtained through the use of the RI facilities are presented, in the past 3 years

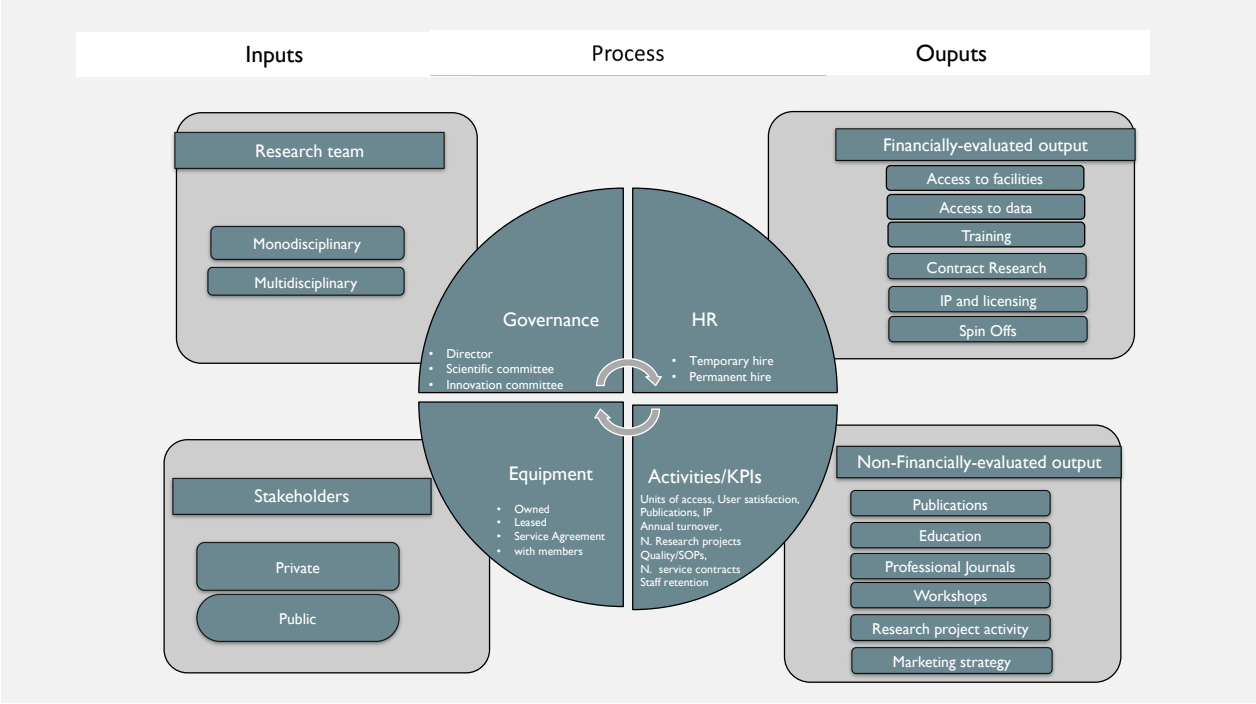
73. Average number of graduate/postgraduate students using RI training offer, in the last 3 years

74. Average number of graduate/post-graduate students accessing RI services, in the last 3 years

75. Do you require that the RI is acknowledged in scientific publications/reports, when results are obtained through the use of the RI?
Yes; No; Don't know/cannot answer

76. What is the percentage of your services which are offered for free?

Appendix 2 - RI Sustainability Model Outline Figure Template



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Appendix 3 –T4.4 Event "Planning-for-sustainability-of-research-infrastructures" (May 2021)

- https://www.ceric-eric.eu/2021/06/02/overview-►-planning-for-sustainability-of-research-infrastructures/
- https://www.eric-forum.eu/2021/06/02/overview-►-planning-for-sustainability-of-research-infrastructures/
- https://www.esfri.eu/latest-esfri-news-project-landmarks-news/accelerate-and-eric-forum-planning-sustainability-ris

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