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KEY DRIVERS IN SECURING THE LONG-TERM SUSTAINABILITY OF A PAN-EUROPEAN DISTRIBUTED RESEARCH INFRASTRUCTURE

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Abstract

This article aims to provide insights on how to create a sound financial model to secure the financial sustainability of a pan-European distributed research infrastructure (RI). The financial sustainability is a key challenge for any Research Infrastructure (RI) sustained by the European Strategy Forum on Research Infrastructures (ESFRI) along its construction and implementation process (nearly 10 years) due to its large-scale size and complexity. Therefore, the Horizon 2020 (H2020) and Horizon Europe call dedicated to the different phases of ESFRI RIs requested/request thorough financial calculations, pushing the RIs' members to pay special attention to the financial aspects in order to overcome any financial shortcomings and make sure that these RIs will survive on a long-term with the aim of fulfilling their mission and objectives. In this regard, the article presents the approach applied in showing the long-term financial sustainability of METROFOOD-RI, a future distributed-RI operating in the ESFRI domain of Health & Food. METROFOOD-RI was included in ESFRI Roadmap in 2018 as an Active Project and in May 2022 completed its preparatory phase financed under the H2020 METROFOOD-PP project. It focuses on moving forward to METROFOOD-ERIC and becoming an ESFRI Landmark. National R&D Institute for Food Bioresources – IBA Bucharest is an active member of this RI and it was fully involved in preparing its financial plan, cost book and business plan. The document describes the steps taken in showing the financial sustainability of METROFOOD-ERIC, financial options, costs and revenues.

Key words**:** *research infrastructure, agri-food, financial sustainability, costs*

INTRODUCTION

The European Commission defines, evaluates and implements strategies and tools to provide Europe with world-class sustainable Research Infrastructures. RIs are notable research facilities providing resources and services, specifically designed to address global complex challenges in various key domains that the European Strategy Forum on Research Infrastructures (ESFRI) set as top priority for action [7].
ESFRI elaborates a long-term European strategic planning for the development of RIs and facilitates multilateral initiatives leading to the better use and development of RIs, at EU and international level. It identifies and financially supports new pan-European RIs or major upgrades to existing ones included in a document dedicated to such RIs entitled ESFRI Roadmap [1].
ESFRI Roadmap includes an assessment of the research landscape and presents the list of RIs according to key domain, typology and phase. The document is updated on a regular basis, based on the needs of the European scientific community. Once an RI is included in the ESFRI Roadmap, it has the opportunity to access funds under the European Commission funding programmes, i.e., Horizon Europe, by applying to specific calls dedicated to sustain such RIs in each phase of its lifecycle (e.g., design, preparation, construction phase) [2].
Most of the ESFRI RIs are distributed [3] with the aim of enhancing collaboration and integration among various research institutions/ organisations, fostering innovation, sustaining co-creation, and

making thus, a wider impact, not only at the A distributed RI (Fig. 1), as defined by ESFRI, represents a research facility that is geographically dispersed. It is composed of a Central Hub and an interconnected network of National Nodes, the facilities being located in different locations (e.g., ACTRIS, DANUBIUS-RI, ELI, METROFOOD-RI) [11].

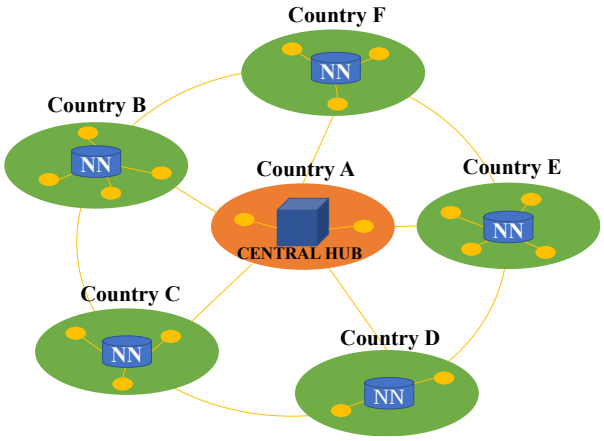

Fig. 1. Distributed RIs
Source: adapted after European Commission - Supporting the Transformative Impact of Research Infrastructures on European Research.

METROFOOD-RI "Infrastructure for Promoting Metrology in Food and Nutrition" was created as a distributed RI aimed to promote scientific excellence in the field of food quality and safety. It provides metrology services in food and nutrition across various highly interdisciplinary, interconnected fields along the food value chain, such as agri-food, sustainable development, food safety, quality, traceability and authenticity, environmental safety, and human health [9].
METROFOOD-RI is perfectly aligned with European policy objectives and strategies, specifically the European Green Deal [4] with its main component strategy Farm to Fork. The main initiatives of this strategy are: sustainable food production; food security; sustainable food processing; sustainable food consumption and the shift to healthier & sustainable diets; food loss and waste and food fraud [5].
Metrology is the foundation of any measurement system and provides the tools to make the measurement results reliable and comparable. To have a Metrological RI able to allow trade, demonstrate the quality of products and services and strengthen the knowledge base for decision-making in the environmental, health and forensic sectors is an essential factor [8].
The development of METROFOOD-RI enables the realization of a global measurement system, that makes uniform every aspect of a measurement (unit of measurement, reference materials and reference methods, procedures for the assessment of competence, procedures for quantifying measurement uncertainty, etc.), increasingly improving the quality of measurements, especially in terms of reliability and comparability of the results.
At present, 48 partners from 18 countries (Italy, Belgium, Switzerland, Czech Republic, Germany, Spain, Finland, France, Greece, Hungary, Moldova, Republic of North Macedonia, Netherlands, Norway, Portugal, Romania, Republic of Slovenia and Turkey) are involved in the creation of METROFOOD-RI [12][10].

MATERIALS AND METHODS

The financial model was built considering the set-up of a European Research Infrastructure Consortium (ERIC) which is a specific legal form that facilitates the establishment and operation of RIs with European interest [6].
The methodology consisted in estimating all costs and potential revenue streams for the Central Hub and the National Nodes.
Consequently, a cash flow was prepared for the Central Hub and a separate one for the National Nodes. Costs and revenues were well-founded, based on reasonable judgement, using a prudent approach. Costs were estimated based on the personnel costs of the participating country, actual costs and quotations per (similar) equipment/ consumables/ maintenance services.
Diagrams were created to visually represent the key aspects related to METROFOOD-RI.

RESULTS AND DISCUSSIONS

RI's structure

METROFOOD-RI will be built on a Hub and Node model, composed of a Central Hub in Italy and a network of National Nodes (NN), one NN created per each country involved. Some NNs entail more partners such as Italy, Romania, the Republic of Macedonia, and Slovenia, which will be in turn organized in a network of Centres.

METROFOOD-ERIC will be set as a legal entity to take advantage of the benefits provided by the ERIC status such as more flexibility and exemptions from VAT and excise duty. In fact, it will represent the Central Hub acting as an "umbrella" of all NNs, in charge of the coordination/ management of the RI, while the NNs, will be totally independent units, bearing the responsibility of ensuring their self-sustainability. Consequently, the Central Hub represents the coordinating/ management office of the ERIC, while the NNs will carry out the R&D activities and be involved in the service provision. Having that said, the financial plan was prepared separately, on one side for the Central Hub and on the other side for the NNs. In this way, ERIC will focus mainly on covering the Central Hub costs which facilitate its operation, accounting and management systems, whereas each NN will make sure it has sufficient funds for supporting investments in assets or upgrades, as well as costs related to day-to-day operation.

The ERIC will be composed of Members and Observers who will be entitled to perform research activities according to their research facilities and capabilities following their rights stipulated in the ERIC's Statute.

This way of structuring METROFOOD-RI is aimed to facilitate different aspects in terms of finances, economics, logistics, procurement, accounting and so on.

Financial model

Bearing in mind that METROFOOD-ERIC depends on the activities performed by the NNs and other external institutions (if the case), the financial model was designed to integrate all parts, meaning the Central Hub and the NNs, as a whole, because the viability and feasibility of a distributed-RI depend on both ERIC and NNs' financial sustainability (Fig. 2).

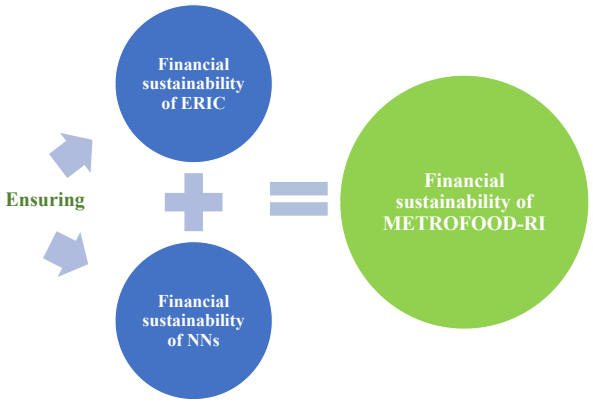

Fig. 2. Approach related to the financial sustainability of a distributed RI
Source: Own results.

Therefore, starting from the RI's structure, the financial model was developed gradually, step by step, having in mind the global picture of the RI.

Step 1 - Cost book

This step consisted in estimating the costs for setting and running the whole RI, meaning the costs for the ERIC (the Central Hub) and the costs at NNs level, as shown in Fig. 3.

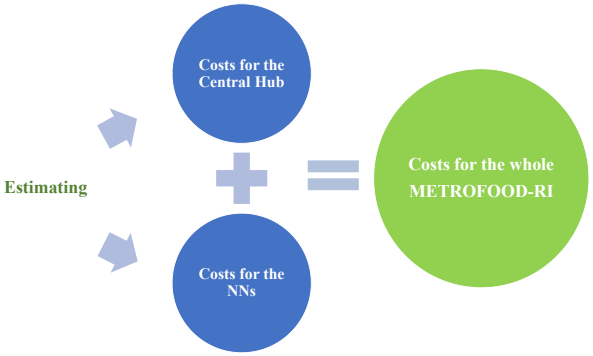

Fig. 3. Approach related to costs estimated for a distributed RI
Source: Own results.

The Central Hub costs were calculated in detail for the different cost items in order to reach a higher confidence level of the estimated costs for setting and running the Central Hub, the total cost being further used in defining the financial contribution for being

Member or Observer of the METROFOOD-ERIC.
The Central Hub costs include personnel costs, start-up costs/ registration taxes, and building and operation-related costs.
The personnel costs were estimated based on the salary level in the hosting country, in our case Italy, taking into account the professional profiles, responsibilities, seniority level, and full-time equivalent.
The costs at the NNs level were calculated starting by preparing a cost-breakdown per each institute, then aggregated by each NN and finally, calculated in total NNs. For example, in the case of METROFOOD-RI, the cost-breakdown was performed by each of the 48 organizations, then grouped by each country (to form the NN) and afterwards, making the sum of all NNs in order to have the whole picture with the contribution of each NN and the magnitude of the RI.
Only in this way, by knowing all types of costs, each Node will be able to figure out both income and financing sources necessary to cover the costs incurred for being part of this large RI, with the aim of being sustainable in the long run.
In order to do so, each institute have decided the pre-existing facilities, both physical and electronic, and the new equipment needed to be purchased and shared with METROFOOD-RI for the operation and specific service provision.
It is worth mentioning that METROFOOD-RI relies on pre-existing facilities, therefore a list of the current assets that each partner puts at the disposal of the ERIC has been provided in the cost book to showcase their great capacities.
For each Node, the following items have been calculated: costs for new equipment and % dedicated to METROFOOD-RI; costs for new e-resources (non-physical assets) and % dedicated to METROFOOD-RI; personnel costs and FTE dedicated to METROFOOD-RI (for different professional profiles: management, researchers, lab technicians, temporary staff, administration and IT staff); consumables; maintenance; other costs (e.g., training, travels, dissemination, upgrades, accreditation); indirect costs.
The full approach is displayed below in Fig.4.

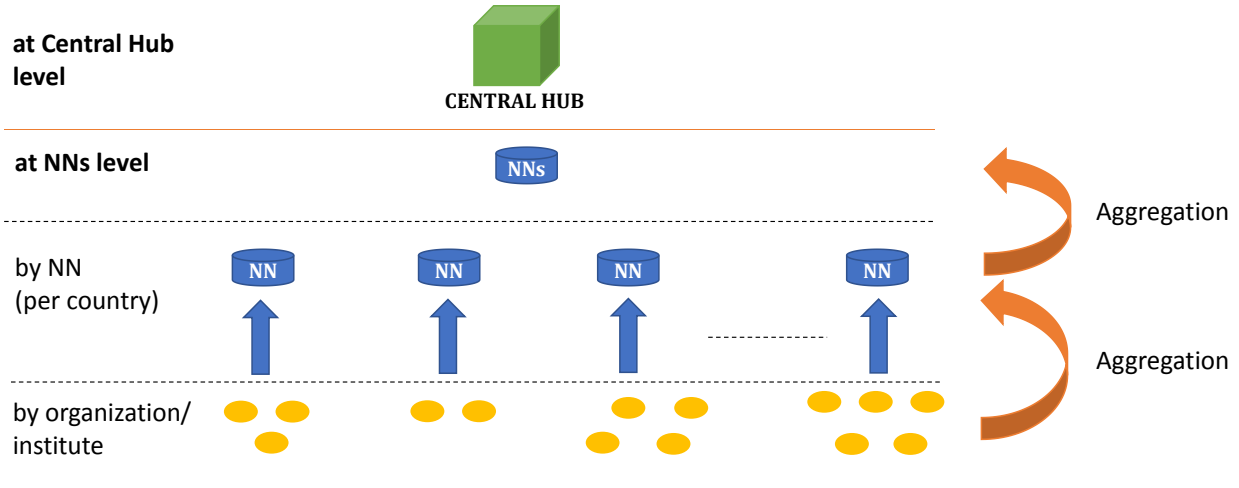

Fig. 4. Methodology used in calculating the costs for METROFOOD-RI
Source: Own results.

Step 2 - Revenues
Similar to costs, revenues were estimated on one hand for the Central Hub and on the other hand at the NNs level.
The potential revenues (cash inflows) of the ERIC mainly consist of:

– Host Country contribution (Italy);
– Membership Contribution from ERIC Members and Observers;
– Commercial/ economic activities from chargeable services;
– EU grants or other calls dedicated to the ERIC.

The funding model was built so that the sum of all contributions from Members and Observers is equal to the annual financial needs of METROFOOD-ERIC. This means that the funds needed to cover ERIC's costs are secured in full.

Different alternative criteria have been taken into consideration for calculating the financial contribution that ERIC members have to provide annually in order to support the costs that ERIC:

- Gross Domestic Product (GDP) per country
- GDP per capita
- Combination between GDP per country and GDP per capita
- GDP exact values per Country

In the end, the partners proposed to go with the combination of GDP per country and GDP per capita.

The scheme of the financial contribution is presented in Fig.5.

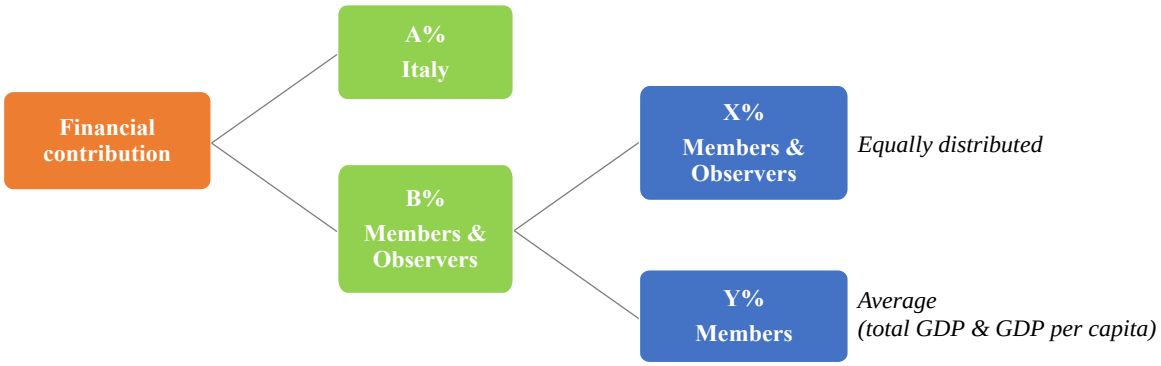

Fig. 5. Example of a mathematical formula for calculating the financial contribution of partners
Source: Own results.

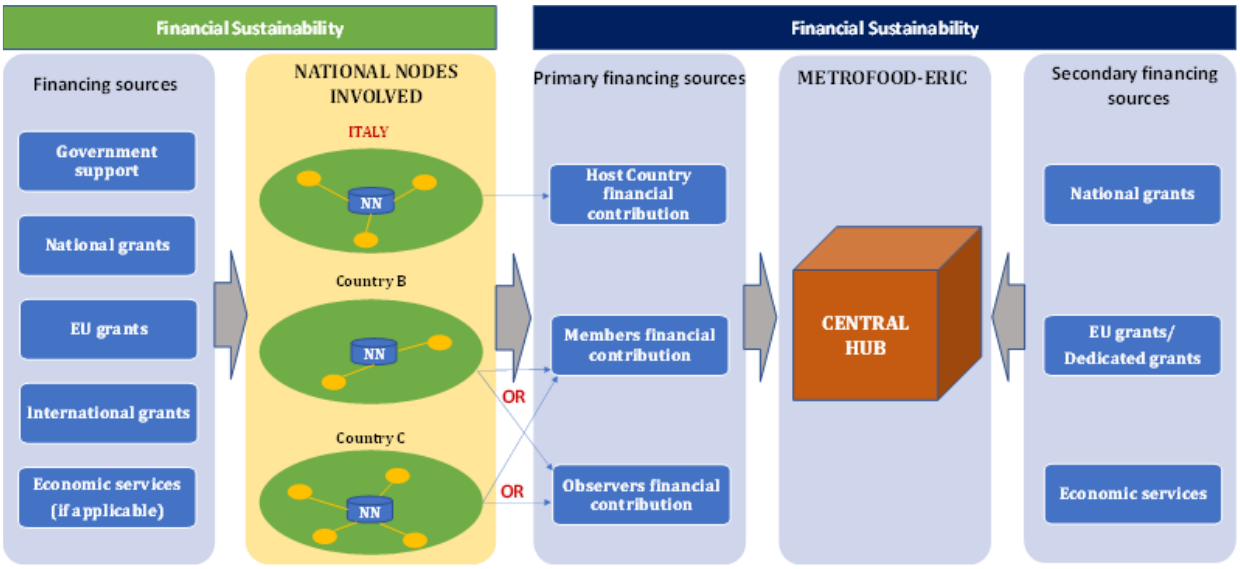

Fig. 6. Potential financing sources for the National Nodes and the Central Hub
Source: Own results.

The financial contribution was calculated for a 5-year period, according to the period set for it; afterwards, being subject to recalculations.

Different projections on the fees were prepared taking into consideration: the whole cost calculated for the Central Hub, the Countries potentially entering as Members and Observers and the proposed criteria.

Each National Node must ensure its self-sustainability. This means that Members and Observers are responsible for covering their own operating costs. In general, the expenses incurred for setting up a National Node are covered by a dedicated national grant.

Subsequently, each NN should identify additional funds such as:

- Grants from the national Ministry;
- Cash from METROFOOD-ERIC depending on the services provided under its brand;
- In-kind contribution from each member of the NN.

Various financing sources for both ERIC and NNs (Fig.6) were considered in view of ensuring financial sustainability.

Step 3 - Financial plan (cash-flow)

The costs of the ERIC will be fully covered by the financial contribution paid by the NNs included as Members or Observers. Furthermore, each NN, either Member or Observer, will have to cover its operating costs concerning METROFOOD-RI and the investments and upgrades necessary to perform the R&D activities for the ERIC. In this way, there will be no problems in ensuring the financial sustainability of the ERIC, whereas the National Nodes will make investments depending on its financing sources available.

The cash-flow has been forecasted since the beginning of the project (PRO-METROFOOD) and throughout a 25-year timeline to reveal the amount of costs incurred along the design, preparation, construction and operation of METROFOOD-RI.

CONCLUSIONS

Preparing a rigorous financial model for such complex RIs, as in the case of METROFOOD-RI with 48 organizations from 18 countries, requires a great effort, a lot of financial calculations, solid knowledge and experience in accounting, finance, economic-financial analysis, project management, so that the assumptions, the financial estimates and projections be as accurate as possible.

It is a great challenge in deciding the mathematical formula for calculating the financial contribution of each country joining the ERIC as a Member or Observer. Each financial option based on the above criteria could lead to the significant difference in the financial contribution of a country, therefore, a combination between a fixed amount and a variable one would be more appropriate and acceptable to partners. This is a complex process, which entails long discussions and negotiations among partners. Nevertheless, the financial commitments from the ministries of each country involved are essential in securing the funds necessary for large-scale RIs.

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