

Project Report

A report on recommendations for the most suitable financial contribution model for the Distributed System of Scientific Collections Research Infrastructure (DiSSCo-RI)

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Abstract

A key consideration during the preparatory phase project DiSSCo Prepare – which laid the foundations for the future Research Infrastructure DiSSCo (Distributed System of Scientific Collections) – was the need to establish a small number of alternative viable financial contribution models and a scalable formula which could be presented to potential funders, with a view to obtaining the minimum financial contribution necessary for DiSSCo to operate, as well as considering how the RI could grow with increased national funding.

This report briefly explains the ERIC funding framework – as chosen for DiSSCo – and its legal constraints, in order to explain the key role played by national member contributions in the viability of an ERIC. An essential annex of the statutes that will be signed by all members of the ERIC is the member fee calculation. A proposal for the DiSSCo member fee calculation is set out in this document and is based on three main indicators: economic power (GDP), annual spending in research and development and population size. In the context of DiSSCo – and to ensure the ERIC can function – these indicators are connected

to a fixed baseline fee of €50,000, in order to guarantee a minimum significant annual contribution from each participating country and avoid contributions that will be more expensive to manage than to benefit from. This baseline is multiplied by contribution factors which propose different ways to weight the various indicators.

The method is established on an ideal scenario, whereby all 27 EU members, as well as the UK, Iceland, Norway and Switzerland sign the DiSSCo statutes and agree to the proposed member contribution calculation, amounting to €4.5 million for the annual budget of the ERIC. This scenario remains highly unlikely; therefore, a scaled approach has been envisaged, meaning the initial engagement of some countries will allow DiSSCo to begin its operation and implement its business strategy, whilst the growth of the ERIC and its activities is likely to evolve proportionally to the number of national members it is able to engage.

This report also looks at the ways in which funding could be distributed amongst the DiSSCo members in order to implement decentralised services.

Keywords

natural science collections, European Research Infrastructure Consortium, specimen digitisation, financial contributions, national contributions

List of Acronyms

BBMRI: Biobanking and Biomolecular Resources Research Infrastructure
CESSDA: Consortium of European Social Science Data Archives
CETAF: Consortium of European Taxonomic Facilities, Brussels
DARIAH: Digital Research Infrastructure for the Arts and Humanities
DG: Director General
DiSSCo: Distributed System of Scientific Collections
EATRIS: European infrastructure for translational medicine
EC: European Commission
ECCSEL: European Research Infrastructure for CO₂ Capture, Utilisation, Transport and Storage
ECRIN: European Clinical Research Infrastructure Network
EMBRC: European Marine Biological Resource Centre
EMSO: European Multidisciplinary Seafloor and water column Observatory
EPOS: European Plate Observing System
ERA: European Research Area
ERDF: European Regional Development Funding
ERIC: European Research Infrastructure Consortium
ESF: European Social Funding
ESFRI: European Strategy Forum for Research Infrastructure
ESS: European Spallation Source
EU: European Union
EU-OPENSREEN: European Research Infrastructure Consortium for chemical biology and early drug discovery
EURO-Argo: Coordination and strengthening of the European contribution to the international Argo programme
GA: General Assembly
GDP: Gross Domestic Product
GERD: Gross Domestic Expenditure on R&D
GNP: Gross National Product
HICP: Harmonised Index of Consumer Prices
ICEDIG: Innovation and consolidation for large scale digitisation of natural heritage
ICOS: Integrated Carbon Observation System
INSTRUCT: Distributed research infrastructure making high-end technologies and methods in structural biology available to users
IO: International Organisation
IT: Information

TechnologyLifeWatch: e-Science European infrastructure for biodiversity and ecosystem research
Meise BG: Agentschap Plantentuin Meise
MNHN: Muséum national d'Histoire Naturelle, Paris
MoU: Memorandum of Understanding
Naturalis: Naturalis Biodiversity Center, Leiden
NHM: National History Museum, London
NN: National Node
NSC: Natural Science Collections
OECD: Organisation for Economic Co-operation and Development
R&D: Research and Development
RBINS: Royal Belgian Institute of Natural Sciences, Brussels
RI: Research Infrastructure
SGN: Senckenberg Gesellschaft für Naturforschung, Frankfurt
SHARE: Survey of Health, Ageing and Retirement in Europe
SLA: Service Level Agreement
SYNTHESYS+: Synthesys of Systematic Resources
UN: United Nations
VAT: Value Added Tax

Introduction

DiSSCo, the Distributed System of Scientific Collections, is a distributed European Research Infrastructure (RI) unifying access to Natural Science Collections (NSCs) and delivering it to scientific communities and beyond. Bringing together 170 institutions across 23 countries and combining earlier investments in data interoperability practices with technological advancements in digitisation, cloud services and semantic linking, DiSSCo aims to make the data from NSCs available as one virtual data cloud, connected with data emerging from new techniques and not already linked to specimens.

This article reflects on the report provided for the DiSSCo Prepare project on Financial Readiness (Landel et al. 2023b). It contains an analysis of financial contribution models and their suitability for DiSSCo and a critical analysis of European Research Infrastructure Consortia (ERIC) that are already in operation. Providing a successful application, DiSSCo aspires to become an ERIC, benefitting from a status created specifically by European legislation for Research Infrastructure and reliant on contributions from member states, with the added advantage of improved access to EU-funded calls.

The DiSSCo infrastructure is characterised by each country being a service user and a service provider. The services are similar for each participating institution; they provide collections which have their specificity regarding taxa, age, location etc. DiSSCo runs on a hub that organises and manages the transactions between the different institutions and the users through a portal and a series of e-services. Therefore, the countries in the ERIC DiSSCo have to fund this hub.

Project context

This project report was originally written as a formal deliverable (D4.3) of the DiSSCo Prepare project (Landel et al. 2023b). As such, the document was reviewed by project partners and submitted to the European Commission. Some minor changes have been made to the original deliverable in order to render this version suitable for publishing – this includes the removal of some information on European funding opportunities – however, the authors consider this as the definitive version of the report.

The following text is the formal task description (Task 4.3) from the DiSSCo Prepare project's Description of work:

Develop the most suitable model for national contributions, based on the existing ESFRI landscape and ERICs; for this task, WP4 will link with WP7 [Governance, Policy & Legal frameworks] regarding legal requirements and DiSSCo Prepare WP8 [Stakeholder engagement & Communication Strategy] for the specialisation graph. This task will especially focus on the national funding mechanisms by assessing the functioning of other existing infrastructures already legally established. Integrating the lessons learned will be essential to determine the contribution model of DiSSCo. In coordination with WP7 and WP8, it will be important to consult the funding mechanisms in the different DiSSCo countries to seek a globally-endorsed model for the implementation and consolidation phases.

Understanding current practice for ERIC member contributions

To begin to understand the potential contribution frameworks available to DiSSCo, a range of bibliographical resources were studied and a benchmarking exercise was carried out which benchmarked DiSSCo against sixteen ERICs in operation. This allowed the team to adjust their calculation, based on a realistic approach. It also gave an overview of typical variables which are used in national contribution models (GDP, GDP/Capita etc.).

Another important consideration was developing an understanding of the national funding landscape in each of the DiSSCo National Node representative countries in order to better anticipate the potential funders' expectations and to equip DiSSCo with a toolkit to engage funders in the construction process. Representatives from other Research Infrastructures were also invited to share their experiences.

The work was further informed by expertise from a subcontractor, X Office, whose knowledge of ERICs helped the DiSSCo team understand the pitfalls and opportunities of the ERIC landscape.

The ERIC framework

The ERIC status created by the European regulation of 25/06/2009 (European Commission 2009) is recognised throughout the Union. Awarded by the European Commission, it allows privileged access to EU-funded calls for projects and benefits from VAT exemption in most member countries. It is based on a commitment from at least three countries (including at least one from the EU), over a period of at least three to five years, supported by a business plan and a provisional budget, which is considered as a commitment from the countries concerned.

ERICs are broad in both mission and service provision and are not governed by any one single applicable funding scheme, although they are highly influenced by negotiations between the EU and Member States. Funding mechanisms should be adapted to each

ERIC, although national member contributions are the bedrock of the funding, at least in the early stages.

Main patterns for the rules governing ERIC national contributions

A benchmarking exercise was carried out over 16 operational ERICs in order to study the main variables of national contribution models. It was a way to identify the main rules to focus on in order to develop a contribution system for DiSSCo. This work was based on the EUR-Lex websites (European Union 2023) containing the official versions of ERICs statutes.

The benchmark includes links to the published statutes of the ERICs; their domain; starting year; number of members and observers; hosting country; GDP (gross domestic product) per inhabitants of hosting country; OECD price level indices of 2019; number of members during preparatory phase; country of the coordinator during preparatory phase; host country contribution (with amount only for France); national cash contributions in 2019; R&D project volumes; income figures (only some identified); other income; host country cash contribution; host country in-kind contribution; other in-kind contributions; and total amount. It also studied information on the membership of the 16 ERICs, such as the type of membership contribution and the rules regulating it, financial figures and data sources.

According to this benchmark, the main rules that exist amongst ERICs statutes are:

- A minimum and a maximum fixed annual membership fee;
- A distinction made between members and observers;
- A place given to International organisations;
- Possibility to add a rule for variable funding;
- A maximum threshold for contributions above which a single member-country cannot provide the equivalent on its own;
- A fixed rule for Host premium contribution;
- A distinction between in-kind and cash contributions;
- A fixed rule to compensate for inflation over time;
- A minimum 5-years commitment;
- Rule in case of early withdrawal;
- Rule for non-member/observer users;
- Rule for late contribution;
- New member adjusted contributions;
- Rules for non-EU countries;
- Cost perimeter covered by the national contributions.

The ERICs studied were created between 2011 and 2018 and are not all in the same scientific field as DiSSCo (environment) (European Strategy Forum on Research Infrastructures 2021). The minimum total amount of annual contribution identified is €220,000 per year and the maximum €2.2 million per year. These data were collected via Internet searches, including annual reports that are available on the ERIC page of the EC

website. Considering that ERIC annual budget reports do not always show clear budgetary divisions in income sources, this information may have some inaccuracies.

Comparison with DiSSCo's requirements

Table 1

Table 1. Overview: ERIC contribution model compatibility with DiSSCo.	
	ERIC contribution model compatibility with DiSSCo
BBMRI	Compatible
CESSDA	Not compatible
DARIAH	Not compatible
EATRIS	Not compatible
ECCSEL	Not compatible
ECRIN	Not compatible
EMBRC	Not compatible
EMSO	Not compatible
EPOS	Compatible
ESS	Not compatible
EU-OPENSREEN	Compatible
EURO-Argo	Not compatible
ICOS	Not compatible
INSTRUCT	Not compatible
LifeWatch	Compatible
SHARE	Not compatible

Although some of the above ERICs are incompatible models for DiSSCo, they reveal some financial rules which could be considered within the DiSSCo member contribution model. These include:

DARIAH – the Digital Research Infrastructure for the Arts and Humanities – imposes an automatic increase of 2% per year of the national annual contribution to compensate for inflation and a monthly calculated fee for new members joining.

EATRIS – the European infrastructure for translational medicine – requests compensation in case of withdrawal of larger countries (> 7% of total contribution).

Compatible models for DiSSCo

The BBMRI model could be used for DiSSCo as it provides both fixed and variable contributions. The variable share is based on the GDP of participating countries. An Observer contribution is included (variable share is 30% for the GDP). There is a maximum of 25% for individual countries and international organisations pay a fixed amount that is individually calculated and fixed by the General Assembly (GA).

EPOS statutes contain a detailed formula on how to calculate the membership fee. The contribution is 50% equally fixed and 50% according to GDP contribution. The minimum contribution is 50 k per annum. In principle, this model could be recommended for DiSSCo, with a question mark over the rule of voting rights in proportion to fees, to be negotiated by potential funders.

The EU-OPENSREEN contribution model combines equal fixed amounts for all member countries (25%) and a variable share of 75% according to GDP per capita (different for member, observer and host countries). The model includes a limit of 50% of total contributions maximum for any individual member. In principle, a model like this could work for DiSSCo.

LifeWatch has implemented a GDP-dependent linear-based contribution model, with a minimum and maximum threshold, although the statutes do not show these thresholds in detail. This constitutes the simplest model for calculating mandatory annual contributions and, therefore, it is a possible model for DiSSCo. The LifeWatch budget is always fixed for 5 years.

Takeaways – Contribution models are typically intended to meet the following objectives:

- The different countries' shares should be calculated according to a transparent methodology relevant to the purpose of the ERIC, such as their population size, economic power, number of potential users, R&D spending or shall be equal for all;
- The method chosen shall be based on transparent, easy-to-acquire statistics and should make comparisons between countries possible;
- Can have minimum and maximum thresholds in numbers as well as a maximum % for each individual country;
- Include a specific rule or % for the host country premium;
- May include an automatic adjustment for inflation;
- Could foresee a specific fee for countries withdrawing early.

Main recommendations for DiSSCo national membership fee calculation

As the above variety demonstrates, there is no classic model which ERICs can copy and paste or which all countries have agreed on. Therefore, each ERIC needs to develop its own specific model, adjusted to its specificities and needs. Indicators relevant to the member contribution calculation can include:

Population size is a good first indication in approaching comparability as it is easy to identify for most countries. It does not, however, reflect the economic power of a country nor its R&D capacity.

Economic power is typically represented by **Gross Domestic Product (GDP)** or **Gross National Product (GNP)**. Both represent the total market value of all goods and services produced over a certain period. However, they are calculated in slightly different ways. GDP is the value of the finished domestic goods and services produced within a nation's borders. On the other hand, GNP is the value of all finished goods and services owned by a country's citizens, whether those goods are produced in that country or not. While GDP limits its interpretation of the economy to the geographical borders of the country, GNP extends it to include the net overseas economic activities performed by its nationals. GDP – sometimes called GNI (Gross National Income) – is the more frequently used of the two indicators. As countries might expect annual differences in GDP, some ERICs prefer to calculate the average GDP over a number of years (typically 3 years).

Research and Development: R&D indicators are divided into gross:

1. gross domestic expenditure on R&D (GERD);
2. R&D expenditure by sector of performance; and
3. R&D expenditure by source of funds.

All these figures are available for EU and OECD countries. **GERD** includes expenditure on research and development by business enterprises, higher education institutions, as well as government and private non-profit organisations. In order to make the figures more comparable, GERD is often expressed relative to GDP or in relation to population. **The ratio of GERD to GDP** is also known as R&D intensity. As most R&D expenditure is covered by industry and different countries have a different industrial base, countries might not be comparable. Alternatively, one might look at the higher education sector or private non-profit sector. Finally, it is possible to use **R&D expenditure by source of funds**, which describes the origin of the R&D funding for a statistical unit. Performer-based reporting of the sums which one unit, organisation or sector has received from another unit, organisation or sector for the performance of intramural R&D. R&D funds are identified with two criteria: there must be a direct transfer of resources and this transfer must be both intended and used for the performance of R&D. Source-based reporting of extramural expenditure which are the amounts a unit, an organisation or a sector reports having paid to another unit, organisation or sector for the performance of R&D.

Number of users per country: very often institutions would like to use **the number of potential users of a country or, if that is not available, the number of researchers**. R&D personnel consists of all individuals employed directly in the field of R&D, including persons providing direct services, such as managers, administrators and clerical staff. R&D researchers can be employed in the public or the private sector - including academia - to create new knowledge, products, processes and methods, as well as to manage the projects concerned. Countries with a stronger industrial base, therefore, might have a

higher number of R&D staff, making it more difficult to estimate potential users of a RI, who currently come mainly from academia or the public sector.

For most countries, reliable past and current statistics are available from EUROSTAT, OECD.Stat and World Bank Open Data. Additional variables, not linked to relative financial statistics, include:

Introduce a threshold: as some EU countries can be very small (e.g. Luxembourg) or very large (e.g. Germany), consortia developing a contribution model want to implement thresholds to ensure fairness. This might make sense when the formula developed is only based on population size or economic power alone. In this case, it is possible to introduce absolute or relative thresholds. Examples are minimum and/or maximum amounts or percentages. Another possibility is to split the contribution into fixed and variable amounts. In the latter case, there might still be a difference in size (like BBMRI or EATRIS) or a fixed amount (like EU-OPENSREEN). To reduce the risk of larger countries having to pay the lion's share of the total member contributions, some ERICs have introduced a mechanism of maximum share (BBMRI and EU-OPENSREEN), with a redistribution of the surplus across other participants.

Host country premium: The host country premium or the additional contribution of the state of incorporation (Statutory seat) can be a delicate matter. Comparisons show a very diverse picture with no common rule. The minimal amount should be able to cover the expenses for the central office (without personnel), incorporation, insurance, taxes etc. In rare cases, several countries pay a premium for hosting specific common services (like ICOS (the Integrated Carbon Observation System) – and BBMRI (Biobanking and Biomolecular Resources Research Infrastructure)); this premium should be calculated transparently. Ultimately, it will depend on negotiation with the potential host country/countries.

Inflation rate: as inflation rates can be high, it is **recommended to include a consideration for inflation in the calculation**. Inflation is the increase in the general level of prices of goods and services in an economy; the reverse situation is deflation, when prices decrease across the board. Inflation and deflation are usually measured by consumer price indices or retail price indices. Within the EU, a specific consumer price index has been developed: the harmonised index of consumer prices (HICP). One possibility is either a fixed or a flexible percentage, calculated, based on the previous year's figures. It would, therefore, be a case of choosing the flexible percentage or using the index relevant for the host country (as most goods and services would be covered there) or an average of participating states (which will need to be recalculated with each new member) or the EU average. However, accounting for inflation each year may be not acceptable by member states if their commitment to ERIC's funding budget is on a 5-term year.

Withdrawal of member countries: withdrawal of member countries will always represent a risk for ERICs as the money might have already been allocated or personnel hired. Therefore, reasonable measures need to be taken to notify in advance (1-2 years ahead of

withdrawal for less equipment-based RIs like DiSSCo) and/or foreseen fees (e.g. in percentage of the annual contribution) for premature departure (25-30% per annum).

Additional possibilities for ERIC contribution models

Embedding international organisations

ERICs allow international organisations (IO), for example the United Nations (UN), to be members or observers. In the case of the UN, it requires the permission of the 193 members. For embedding IO as observers, the Director General (DG) can decide and there is no rule as to how to calculate their contribution. It can be directly negotiated between the IO and the ERIC's GA. It is not mandatory that it is specified in the statutes. For instance, it can be decided during the first GA.

Minimum number of members to guarantee funding the RI

If some members leave the RI over the course of its implementation, it is possible to raise the topic during the GA to decide if national contributions should be increased or the level of service provision decreased. Therefore, the ERIC cannot be launched with fewer than five countries.

In case of withdrawal of a member during the first 5 years of operation, the country concerned will have to pay for all 5 years of their initial commitment. This rule is guaranteed by the ERIC regulation. If a member does not want to pay, the ERIC would have the right to go to court. In case of withdrawal of a member after this 5-year period, the GA should be notified in advance: the notice period should be included in the Statutes.

Minimum contributions expected from observers

There is no rule for the minimum contribution expected from observers, although the details of observers' subscription to the ERIC should be detailed in the ERIC's statutes. It is realistic to ask 1/4 to 1/3 of the full membership fee. If observers have the same rights to access the services as members, 1/3 of the regular member contribution amount may be appropriate.

Definition of in-kind: statutes or service level agreements (SLAs)

This depends on the expectations from the ERIC towards its member-institutions. If the in-kind contribution is strategically important, it is possible to write in the statutes that there will be an expectation on the participating institutions to contribute in-kind. It is also possible to add in the introduction of the ERIC statutes that institutions will be asked to contribute in-kind.

Voting of the budget

Budgetary cycles should not be specifically mentioned in the statutes. Each year the budget is drafted and, as long as the GA agrees with the proposal, it will be actioned. In the

case of higher investments (around 1/3 of the regular member contribution can be a threshold), it is possible to prepare a 2-3-year budget.

States joining mid-year

A rule should be included in the statutes in order to clarify how it would work in case a country joins the ERIC outside of the budgetary cycle. In most cases, countries commit to funding the ERIC for 5 years after joining.

Joining is effective as of the date after the GA has agreed to it, in writing. It is likely that the decision to welcome a new country will be taken during the GA.

Financial penalty in case of early withdrawal

A rule is in place in case a member country withdraws from the ERIC before the end of the first 5 years. A good option is to negotiate early notification in case of a decision to exit the ERIC.

Non-EU countries

Non-EU countries can be assigned the same membership fee calculation. Sometimes, EUROSTAT only holds data for EU countries. In that case, it is possible to use equivalent data from the World Bank or OECD.

ERICs' eligibility to access loans

ERICs can access loans like any private company. In practice, this requires the ERIC to demonstrate its bankability for a lender. The GA is responsible for approving the loan request. As it currently stands, the only case of an ERIC requesting a loan concerns the European Spallation Source ERIC (ESS). The whole construction cost amounted to €2 billion and required a loan guaranteed by the European Investment Bank.

In the case of an ERIC like DiSSCo, the decision should be taken 10 years before the request for the loan.

In case of reserves/cashflow

Reserve authorisation will depend on the financial and monetary rules of the country with statutory seats. The rules will vary from one country to another. In some countries, ERICs are seen as a private organisation and should, therefore, follow private financial rules. In other countries, they are seen as public institutions. Typically, in the EU, public organisations are advised against amassing cash reserves.

DiSSCo national contributions calculation

Each country in DiSSCo ERIC has users and providers; therefore, running the hub is a common goal. Funding the hub is then structured between two extremes: on the one hand, all potential countries (EU27 + associated countries) could participate in funding the ERIC

and, on the other hand, only three countries are required to sign in for an ERIC to be created. Considering the specificities of DiSSCo, the method should be transparent for any country wishing to join the ERIC and based on widely-accepted criteria, so the arrival of a new member or the departure of an existing one should not lead to redesigning the method. The bottom line is that a minimum number of countries should fund the ERIC in order to cover the minimum running cost of the hub.

Introduction to the DiSSCo timeline

DiSSCo's initial developments implemented through EU-funded projects (ICEDIG ("Innovation and Consolidation for Large Scale Digitisation of Natural Heritage", EU Horizon 2020 grant agreement No. 777483), MOBILISE COST (EU COST Action CA17106 on "Mobilising Data, Experts and Policies in Scientific Collections"), DiSSCo Prepare and SYNTHESYS+ ("Synthesis of systematic resources", EU Horizon 2020 grant agreement No. 823827) represent an estimated budget of more than €13 million. This budget mainly includes EU funding as well as in-kind contributions from participating institutions. In February 2023, DiSSCo will stop benefitting from these European funding programmes and enter into its transition phase (see Fig. 1). During the transition period, DiSSCo ERIC's statutes and national annual contributions will be discussed amongst its future Members and Observers. The national contributions will represent the fixed annual budget of the RI. It is the funding on which much of the expenditure presented within this document will rely. The national contributions described within this document are intended to cover core DiSSCo activity for five years: the fixed costs of managing the DiSSCo Central Hub (€1.4 million per year) (Landel et al. 2023a) and provision of core services. This assumption is based on an incremental and realistic approach. DiSSCo will first deploy a basic team with tools to improve access to NSC by helping institutions to follow European shared innovations.

Fig. 1

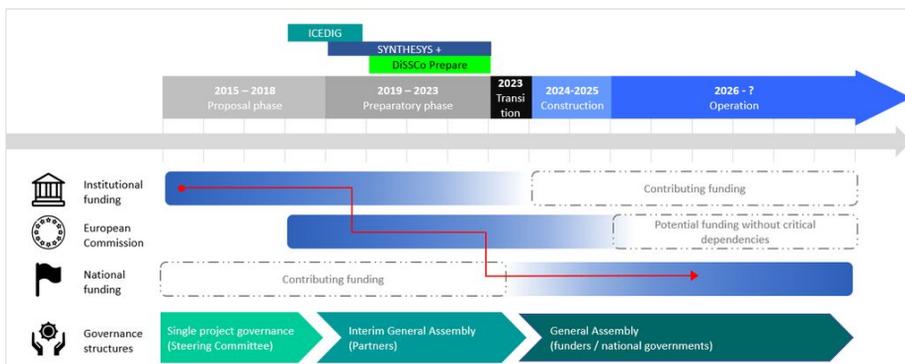


Figure 1. [doi](#)
DiSSCo timeline.

Main principles for DiSSCo annual membership fees

Four principles underpin the DiSSCo annual membership calculation methodology:

1. National membership fees shall be fair and equitable. They shall reflect the resources devoted to science and technology amongst DiSSCo member countries' population size and annual spending on R&D;
2. The national annual wealth creation shall be an indicator for the DiSSCo annual membership fee. It can be an average of the GDP of the three years preceding the budget year concerned;
3. Every member contribution should be sufficiently large – regardless of the size of the economy – to guarantee a minimum annual contribution from each participating country and avoid contributions that will be more expensive to manage than to benefit from;
4. The DiSSCo RI shall be able to annually adjust the contributions, notably in relation to inflation and keep a minimum level of service thanks to membership fees, under the first 5-year commitment.

These principles are supported by the five following recommended rules:

1. Host Country annual membership will represent 25% of the annual cost of the Central Hub Office;
2. Observers shall pay one third of full annual membership, based on the same factors as for members. This is currently being discussed with the national nodes. At this stage, it is a working hypothesis;
3. In-kind will be part of the negotiation with funders. The core Cost Book relies on annual cash contributions to fund the central DiSSCo infrastructure and management. It is understood that the wider RI relies on its member institutions' in-kind contributions;
4. If a new member/observer joins before the mid-year (2 July), they shall pay the full annual fee. If they join the ERIC after the mid-year, they shall pay half of the annual fee;
5. One Member State's annual contribution shall not exceed 50% of total annual contributions to DiSSCo ERIC.

Three relevant indicators for DiSSCo: economic power, R&D spending and population size

The calculation of national annual contributions to research infrastructures should strive to fairly distribute financial commitment amongst its members.

Two possible options on which to base the DiSSCo ERIC formula to calculate the membership fee have been defined: both consider the GDP, R&D spending and population size of potential DiSSCo Member States. Countries do not rank identically if gross or per capita values are considered. If two gross values are used – for example GDP and GERD – the correlation coefficient is high and, therefore, the variables are tightly clustered,

meaning a less equal distribution of funding. Furthermore, countries rank differently with respect to GDP and GERD. As a consequence, mixing gross and per capita in the formula lessens the difference.

Some countries could have annual differences in GDP. To mitigate against this, DiSSCo ERIC national contributions can be calculated on the average GDP and GERD over 3 years (see Appendix 1).

The indicators preselected, GERD/cap, GDP, GERD, GDP/cap, do not vary widely over time. Whilst they did grow between 2017 and 2019, no drastic variation was identified. This means that funding connected to these variables should be stable.

The size of the Natural Science Collections (NSCs) of the participating countries was not selected as an indicator. The figures on the Collections are provided by institutions, potential members and service providers of the ERIC. Meanwhile, the contribution model requires indicators that come from external stakeholders. Population size, GDP, R&D expenditure (etc.) figures are provided by EUROSTAT, World Bank and OECD, therefore, avoid any potential conflict of interest. For some institutions, the figures on the size of collections still need to be clarified, so this is not a reliable indicator.

It could be argued that the most accurate parameter for establishing member contributions would in fact be the size of the scientific community impacted by the establishment of DiSSCo RI. The problem being, however, that we do not, at this stage, know how to calculate this figure. It would require participating governments to carry out a detailed and exhaustive study of the outreach of their Natural Science Collections which would be an extremely costly and timely exercise. Furthermore, it would require each participating government to carry out the same exercise, which would be a huge challenge given the different priorities and budgets of each government.

DiSSCo annual membership (DAM) fee formula

The baseline (defined as F) is set at €50,000 per year, which corresponds to the minimum annual contribution from each Member State in DiSSCo ERIC.

In order to scale national contributions, based on the country's (**x**) annual GDP, GERD and population size (**/cap**), different criteria (**Cri**) are determined. The criteria allow us to rank the countries from 1 to 10. For instance, the country with the lowest GDP is ranked at 1 and the country with the highest GDP is ranked at 10. This is done for every indicator listed. The choice of ranking up to 10 has been made arbitrarily. It is possible to imagine that the scale could go up to 12, 15 etc.

With these criteria, two options are presented: **The first option combines GDP and R&D/cap criteria.** It leads to a contribution factor (A) calculated for each potential member. This contribution factor adds up both criteria and allows us to weigh the importance of each criterium in the calculation. With that option, it is possible to say that the GDP criterion is

more important than the R&D/cap, based on a determined percentage (for instance 75% GDP - 25% R&D/cap).

The second option combines GDP/cap and R&D criteria. It works exactly the same way as for the second option: both criteria can be weighted in the formula.

For every country (**x**) wishing to become a Member State, the annual membership fee is equal to the baseline (**F** = €50,000) multiplied by the contribution factor linked to the country. For each observer, the baseline is one third of the annual membership. In addition, the host premium contribution (**H**) is calculated in relation to an estimation of the Central Hub costs and it should cover 25% of the estimated budget.

Fig. 2

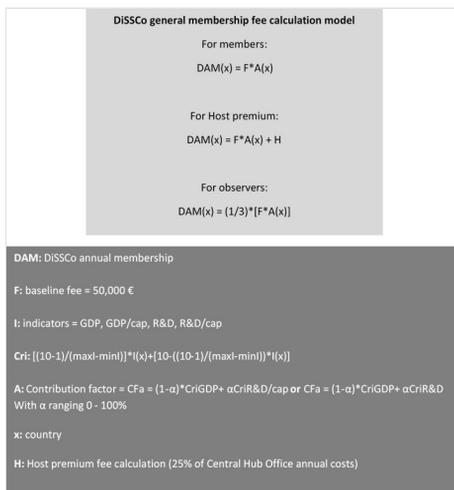


Figure 2. [doi](#)

DiSSCo general membership fee calculation model.

Using the above formula, different options were tested. Tests were done with different distributions (25% GERD/cap - 75% GDP; 80% GERD - 20% GDP/cap; etc.) and the total sum of all contributions was never exactly the same. It was, therefore, proposed that the addition of all contributions should always be equal to €4,500,000. This amount represents the median of all the different results calculated and it means that, whatever percentages are chosen, the total result will always be around €4.5 million. It is understood that probably not all potential countries will sign up to the ERIC, so this total amount will most likely not be achieved, at least not during the first few years of implementation. However, in order to simplify negotiations around the contribution model, it was put forward that, by having a model that is independent from the final sum and which can be tweaked without affecting this amount, negotiators are less likely to choose the minimum possible contribution. By extracting the final amount from the discussion, negotiators are invited to scrutinise the complexity of the calculation in isolation.

Modelling the effects of the DiSSCo national contribution formula

As the DiSSCo national contribution model is flexible, it was possible to test the different options to experiment with the range of values obtained, as shown in the following three combinations:

- GDP and GERD;
- GDP and GERD/cap;
- GDP/cap and GERD.

This section aims to model the effects of these different options on the DiSSCo annual membership fees. It imagines a scenario whereby all 11 DiSSCo Funders Forum members (the Funders Forum being ministerial representatives of potential DiSSCo national funders during its preparation phase) sign the DiSSCo ERIC statutes and annually contribute to funding the Research Infrastructure. Using this scenario, the model simulates the total annual budget of the RI. Finally, it will simulate the medium-term effects of inflation on these contributions.

Option A: GDP and GERD

The first option considers GDP and GERD. With this option, it is possible to weight both criteria differently: 10 weightings were tested.

Fig. 3



Figure 3. [doi](#)

Option A: GDP and GERD testing. Vertical axis: annual monetary contribution per country. Horizontal axis: countries corresponding to table (left).

Fig. 3 shows that option A is not very well balanced as most of the funding comes from four main countries. It is possible to extract the following data from this model:

Table 2

Table 2.

Main data issued from model A, mix of GDP and GERD.

Series	1	2	3	4	5	6	7	8	9	10
GDP	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
GERD	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Standard deviation €	131 722	131 240	130 756	130 415	130 200	130 136	130 232	130 480	130 837	131 565
Min €	61 000	62 000	63 000	64 000	65 000	67 000	68 000	69 000	71 000	72 000
Max €	607 000	618 000	629 000	641 000	653 000	666 000	679 000	693 000	707 000	722 000
Factor	10	10	10	10	10	10	10	10	10	10

The data show that high standard deviation does not vary from one series to another. One understanding is that this model is not balanced and that annual contributions are not equally distributed amongst the members.

Option A also shows high minimum contributions (from €60,000 to €70,000/year) and high maximum contributions (from €600,000 to €700,000 per year). This option may not meet the proposed rule that one country cannot cover more than 50% of the total annual contributions. In addition, there is a factor of 10 between the minimum annual contribution and the maximum annual contribution, which is high in comparison with the other options.

On a positive note, if we test this option with the 11 members of the Funders Forum (Table 3), we see that the research infrastructure would achieve a sufficient budget to cover its annual spending (minimum of €1.4 million per year).

Table 3.

Estimation (in thousand euro) of annual contributions from Funders Forum members with option A.

Series	1	2	3	4	5	6	7	8	9	10
Belgium	133	135	137	140	142	144	147	149	152	155
Bulgaria	67	68	69	69	70	71	72	73	74	75
Denmark	108	109	111	113	115	118	120	122	125	127
Estonia	63	64	65	66	67	69	70	71	73	74
France	432	429	425	421	417	413	409	404	399	394
Greece	86	86	86	86	86	86	86	86	85	85
Italy	331	321	311	300	289	278	266	254	241	228
Netherlands	181	181	180	180	179	178	178	177	177	176
Portugal	90	90	90	90	90	90	89	89	89	89
Slovakia	72	73	73	74	74	74	75	75	76	77
United Kingdom	437	427	417	406	395	384	372	359	346	333

Min €	59 000	58 000	57 000	55 000	53 000	51 000	49 000	47 000	45 000	42 000
Max €	547 000	502 000	461 000	422 000	387 000	353 000	356 000	377 000	397 000	415 000
Factor	9	9	8	8	7	7	7	8	9	10

This shows greater variation in standard deviation: from €120,000 to €86,000. The option with the lowest standard deviation mixes 40% GDP and 60% GERD/cap, resulting in a minimum contribution of €51,000 per year and a maximum of €353,000 per year. There is a factor of 7 between the minimum and the maximum contributions, which is more balanced than for Option A.

If we test this option with the eleven countries in the DiSSCo Funders Forum, we see that, regardless of the percentage chosen, the RI would receive enough funding to cover its annual expenditure (Table 5).

Table 5.

Estimation of annual contributions (in thousand euro) from Funders Forum members with option B.

Series	1	2	3	4	5	6	7	8	9	10
Belgium	144	156	167	177	187	196	204	212	219	226
Bulgaria	63	60	58	55	53	51	49	47	45	43
Denmark	131	153	174	194	212	229	245	259	273	286
Estonia	64	66	68	70	72	74	75	77	78	80
France	398	363	331	301	273	248	224	201	180	160
Greece	84	81	79	77	75	73	71	69	68	66
Italy	307	277	249	223	199	177	156	137	118	101
Netherlands	183	185	186	187	189	190	191	192	193	193
Portugal	89	87	85	84	83	81	80	79	78	77
Slovakia	70	68	66	64	62	61	60	58	57	56
United Kingdom	404	365	329	295	264	235	208	183	159	137
Total estimated	1 937	1 861	1 792	1 727	1 669	1 615	1 563	1 514	1 468	1 425
Total with Host premium	2 287	2 211	2 142	2 077	2 019	1 965	1 913	1 864	1 818	1 775

GDP/cap and GERD

The third option includes population size as an indicator and mixes GDP/cap and GERD. As the formula remains the same, it is possible to weight the different indicators, as shown in the following Table:

Fig. 5

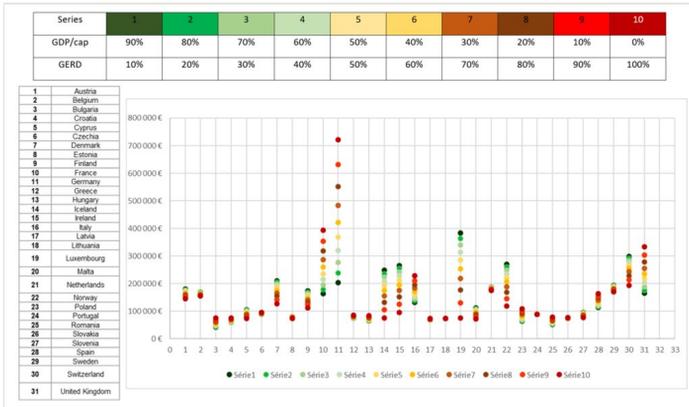


Figure 5. doi

Option C: GDP/cap and GERD. Vertical axis: annual monetary contribution per country. Horizontal axis: countries corresponding to Table (left).

The results from option C are more homogeneously distributed than in options A and B. Only country 11 can reach a disproportionately high annual contribution, but, according to the ratio selected, it is possible to find a more balanced option, as shown in Table 6. This shows that the standard deviation varies from one option to another: from €78,000 to €131,000. Here, the smallest standard deviation is the option mixing 60% of GDP/cap and 40% GERD and all national contributions are the least scattered around the median. With this option, the minimum individual annual contribution is €50,000 per year and the maximum is €320,000 per year. There is a factor of 6 between the minimum and the maximum, making for a more balanced model.

Table 6.

Main data issued from model C, mix of GDP/cap and GERD.

Serie	1	2	3	4	5	6	7	8	9	10
GDP/cap	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
GERD	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Standard deviation €	84 551	81 455	79 152	78 106	79 068	82 412	88 857	98 949	113 068	131 565
Min €	42 000	44 000	47 000	50 000	53 000	56 000	60 000	64 000	69 000	72 000
Max €	384 000	363 000	340 000	320 000	368 000	422 000	483 000	552 000	631 000	722 000
Factor	9	8	7	6	7	8	8	9	9	10

This model was also tested with the 11 Funders Forum members. The total of all 11 contributions covers the expenditure of the research infrastructure and allows for its implementation.

Table 7

Table 7.

Estimation (in thousand euro) of annual contributions from Funders Forum members with option C.

Series	1	2	3	4	5	6	7	8	9	10
Belgium	168	168	166	165	164	163	161	159	157	155
Bulgaria	42	44	47	50	53	56	60	64	69	75
Denmark	211	206	199	192	185	176	166	155	142	127
Estonia	81	81	80	80	79	78	77	77	75	74
France	163	178	196	215	236	260	287	318	354	394
Greece	76	76	77	78	79	80	81	82	84	85
Italy	132	138	146	154	162	172	184	196	211	228
Netherlands	187	186	185	185	184	182	181	180	178	176
Portugal	88	88	88	88	88	88	88	89	89	89
Slovakia	74	74	74	75	75	75	75	76	76	77
United Kingdom	165	176	189	203	218	236	255	278	303	333
Total estimated	1 387	1 415	1 447	1 485	1 523	1 566	1 615	1 674	1 738	1 813
Total with Host premium	1 737	1 765	1 797	1 835	1 873	1 916	1 965	2 024	2 088	2 163

Adjusting contributions according to inflation

One possibility for the DiSSCo annual contribution model is to add inflation as a factor of evolution of the membership fees. This may not be indexed on an annual basis, but instead could evolve every five years (minimum length of commitment).

Inflation is highly unpredictable: as the working hypothesis to test the effect of inflation, we assume 2% annual inflation rate and DiSSCo's statutory seat being in the Netherlands. If the costs of the RI rise due to inflation, it will likely be connected to the inflation rate of the host country. On that basis, it is possible to model the impact of inflation on DiSSCo's income, as shown in Fig. 6.

In line with inflation, three main figures would evolve accordingly:

- The baseline fee (€50,000);
- The total maximum amount with the addition of the 31 hypothetical members (€4,500,000);
- The annual host premium fee (€350,000).

If the RI is launched in 2024, the first indexation of its fees would be in 2029. According to the data connected to the graph above, the following evolution may happen:

- Indexed baseline fee: €55,200;
- Indexed total maximum amount: €4,970,000;
- Annual host premium fee: €390,000.

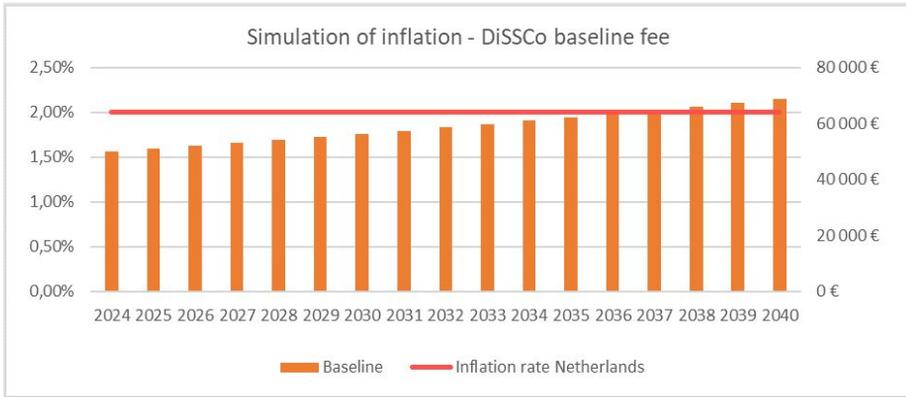


Figure 6. [doi](#)
Simulating inflation, between 2024 and 2040 – Basic number: 2% inflation per year.

If we take the median of annual contributions in 2024 (starting year) and the median of annual contributions in 2029 (+5 years), we obtain the graphs below (Fig. 7, Fig. 8 and Fig. 9). We see that inflation does not have a major impact on the evolution of each country's annual membership fee. On average, the contributions would be increased by 10% between 2024 and 2029.

Fig. 7

Fig. 8

Fig. 9

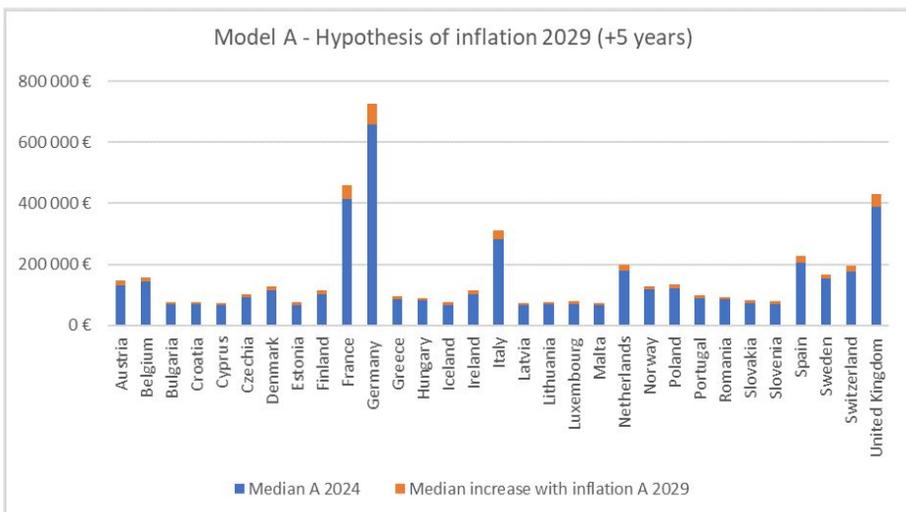


Figure 7. [doi](#)
Simulation of inflation, Model A.

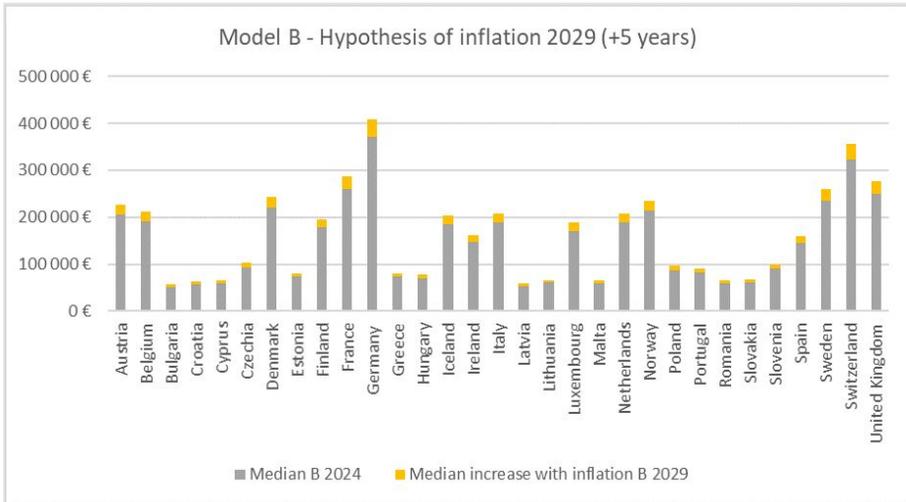


Figure 8. [doi](#)

Simulation of inflation, Model B.

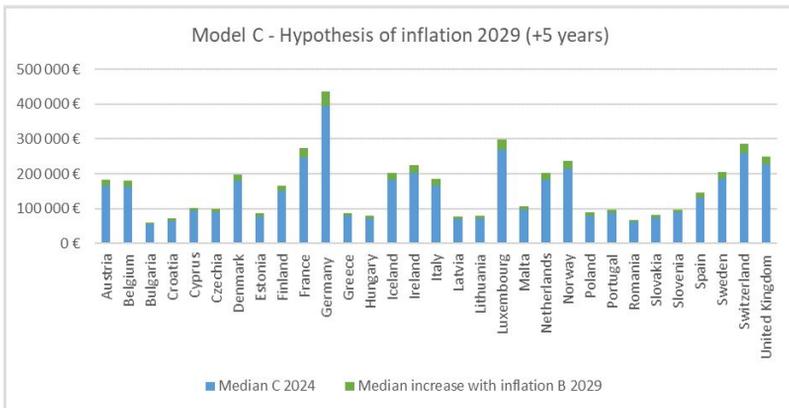


Figure 9. [doi](#)

Simulation of inflation, Model C.

Proposal of the two most balanced options

As shown above, the most balanced options are:

- Option B: 40% GDP and 60% GERD/cap;
- Option C: 60% GDP/cap and 40% GERD.

We recommend these two options to share with DiSSCo potential future funders, summarised in Table 8. As a lot of data can be extracted from this flexible formula, a selection has to be made on the basis of predefined criteria.

Table 8.

2024 Annual membership fees (in euro) according to the two recommended options.

Countries	Option B - GDP & GERD/cap	Option C – GDP/cap & GERD
Austria	211 000	172 000
Belgium	196 000	165 000
Bulgaria	51 000	50 000
Croatia	57 000	64 000
Cyprus	59 000	98 000
Czechia	93 000	90 000
Denmark	229 000	192 000
Estonia	74 000	80 000
Finland	184 000	159 000
France	248 000	215 000
Germany	353 000	320 000
Greece	73 000	78 000
Hungary	70 000	69 000
Iceland	194 000	209 000
Ireland	149 000	228 000
Italy	177 000	154 000
Latvia	52 000	69 000
Lithuania	60 000	73 000
Luxembourg	178 000	314 000
Malta	59 000	103 000
Netherlands	190 000	185 000
Norway	220 000	236 000
Poland	84 000	73 000
Portugal	81 000	88 000
Romania	57 000	58 000
Slovakia	61 000	75 000
Slovenia	92 000	91 000
Spain	137 000	125 000
Sweden	242 000	189 000
Switzerland	334 000	275 000
United Kingdom	235 000	203 000
Total	4 500 000	4 500 000

The graph below illustrates Table 8. The annual contributions remain stable across Options B and C. Except for a few countries (with higher GDP/cap), choosing between the two options will not greatly impact the budgets of the DiSSCo future members.

Fig. 10

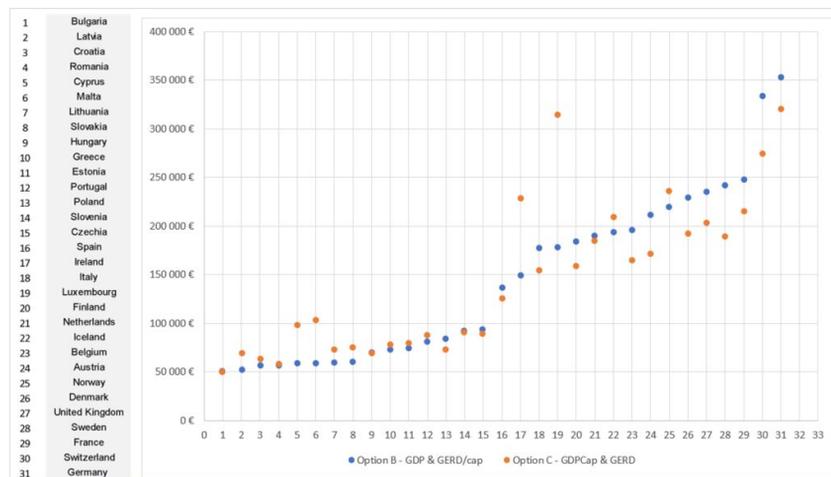


Figure 10. [doi](#)

Visualisation of annual membership fees distribution according to the two proposals selected.

Potential future developments of the DiSSCo RI business model

Growth opportunities for DiSSCo: service provision and integration of member institutions

DiSSCo will be a distributed research infrastructure. This means that its actions will be distributed amongst its member institutions, linked by Natural Science Collections and affiliated services. In this context, the question arises about the articulation between the Research Infrastructure and its members and the management of funding. The national nodes are the contact points between potential funders and the research infrastructure.

A series of workshops held within the context of the DiSSCo Prepare project raised the question of the relationship between the national nodes and the ERIC, as well as the question of the distribution of activities and services within the infrastructure. Through this process, three different levels of contribution model were identified:

Basic model: fixed funds cover fixed expenditure

The first model is simple and relies mainly on contributions from the Member States. It finances the operation of the Central Hub - mainly coordination - and the provision of digital services. This has the advantage of containing much of the decision-making in the hub which provides tools for the member institutions to provide their data. At the same time, it limits the action and, thus, the added value of the infrastructure because it guarantees the

provision of a minimum of services and does not require additional agreements with the nodes to provide additional services on behalf of the infrastructure. If users request access to collections, without direct funding to institutions, then the prioritisation of requests would be at the discretion of the institution according to its funding priorities. Without additional funding from DiSSCo, the quality of services provided by the RI via its members would depend on the alignment between the institution's strategy and the RI's strategy.

Mass digitisation programme model

The second model adds a layer of complexity to the first model. The basis remains the same: national contributions finance the operation of the Central Hub and the digital services. In addition to this model, digitisation programmes can be imagined. These would be derived from a centralised strategy, potentially with types of collections designated as priorities for digitisation. These programmes would be implemented within a number of RI member institutions. The funding arrangements are still to be clarified. In this hypothesis, the ERIC would benefit from centralised funding which would then be distributed amongst its members in proportion to the number of digitised collections. It is possible to imagine different alternatives for implementation, such as digitisation centres spread across Europe. The investments would then be supported by the ERIC. The institutions would have to transport the collections to be digitised to the regional centres. Another option would be for the institutions to organise digitisation within their own institutions. In this case, they would also receive funding from the ERIC.

Income for digitisation programmes could come from the European Union. European Regional Development Funding (ERDF) might be used for the digitisation centres and European Social Funding (ESF) for training the staff who will implement it. DiSSCo ERIC could lead the consortium and coordinate the response to the call for projects. As such, it would also be responsible for monitoring the allocation of funding and the progress of digitisation.

Under this hypothesis, the institutions could see their objectives and actions influenced by the research infrastructure, which would guide part of their missions. When this hypothesis was put forward during a workshop, the representatives of the national nodes expressed doubts about giving up some of their capacity to prioritise their actions.

- **Example from ICEDIG: ERDF covers the implementation of a digitisation centre in Finland:** A national centre of digitisation expertise in Finland, Digitarium was launched in 2010 and operated until 2017, funded by a series of grants from the ESF. Totalling €2.1 million, this funding covered 70-80% of costs, with the remainder coming from the host city and the two participating universities. The funding was used to build the technological base for mass digitisation as well as human capacities. Additional funding of €2 million was obtained from EU FP7 research projects, national RI projects and commercial mass digitisation services. This model of funding in eligible parts of Europe can be attractive for DiSSCo as a means of establishing digitisation factories and Centres of Excellence. The ESFRI Lifewatch is being largely built on a similar basis.

Centres of Excellence funding model

A third level of integration is added to this option, incorporating Centres of Excellence (Hardisty et al. 2020). It is largely inspired by the functioning of other European research infrastructures, such as ELIXIR or BBMRI. In this hypothesis, the institutions holding Natural Science Collections would provide part of their tools for the benefit of the users of the research infrastructure. This model would be derived from the identification of institutional strengths. One hypothesis is that it would be possible to designate institutions with certain facilities or collections as the reference within the RI to provide specific services. They would then be named a Centre of Excellence and included in the list of services provided by the RI.

At this stage, service level agreements are envisaged to bind the ERIC to the Centres of Excellence. They would describe the services provided by the centres on behalf of the RI and they may include expected service levels: the institution must respond to the user in an agreed amount of time, provide a specific service with a specific quality level etc. There is a constraining dimension which implies that, in order to deliver this level of service, institutions will have to hire teams or change the priorities of existing teams to ensure that the contract is met. This has a cost for institutions, particularly if they are receiving funding where they are already committed to a certain level of service. If the RI expects a high level of service, it is conceivable that the SLAs could determine a financial commitment from the ERIC. It would describe the expectations on the services provided by the institution in exchange for funding.

These three different scales of RI implementation have an impact on the level and number of services provided. Digitisation programmes increase the amount of data shared by the RI. Centres of Excellence increase the services provided by the ERIC. However, this implies either a perfect strategic alignment between DiSSCo ERIC's objectives and the objectives of its member-institutions or finding additional funding to cover the expenses supported by the institutions to provide services on behalf of the ERIC. The three models are demonstrated graphically below:

- Basic model: fixed funds cover fixed costs;
- Mass digitisation programme model: DiSSCo as a data producer;
- Centres of Excellence funding model.

Fig. 11

Conclusions

ERICs are designed by the EU to structure the European research ecosystem and to encourage large-scale, international, scientific projects. They provide services via a coordinated network that provides access to facilities and resources.

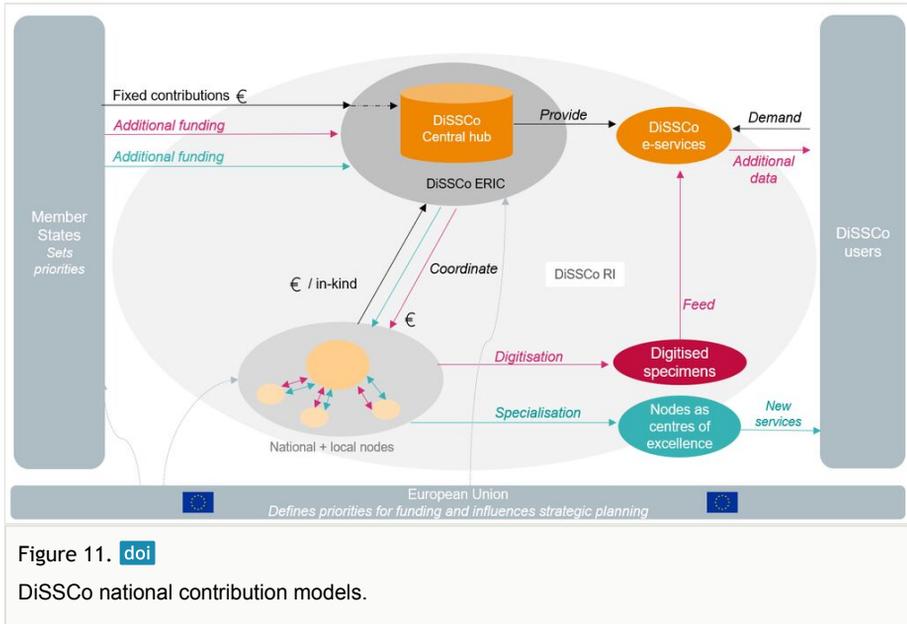


Figure 11. [doi](#)

DiSSCo national contribution models.

On average, more than 80% of ERICs' funding comes from public sources. The most sustainable of these are from Member countries who sign the ERIC statutes and commit to annually funding the ERIC.

For DiSSCo, the contributions from its members should be proportional to their economic power, R&D spending and population size. These three indicators can rank countries via different factors that reflect their potential use of the RI and their economic capacity. In order to ensure a balanced distribution of the costs amongst DiSSCo funders, the most suitable solution would be to distribute the indicators selected either with 40% GDP and 60% GERD/cap or 60% GDP/cap and 40% GERD.

To be sustainably funded with the proposed contributions, DiSSCo needs a commitment from more than the minimum of three members legally required to constitute an ERIC.

The membership fees shall provide annual funding to the ERIC. Once the statutes are signed, the first objective of DiSSCo central hub will be to start the operation of the RI, including the provision of services.

In a perspective of growing the RI, DiSSCo could increase the member countries by convincing them to commit to the RI. In addition, ERICs are eligible for EU funding. These funds require complex and time-consuming preliminary work and they are connected to pre-requirements determined by the EU. In addition, there are some alternative sources of funding, such as national funding: ERICs are eligible for these funds, but there is often a lack of understanding of these opportunities at national level.

Finally, the more the DiSSCo grows and matures, the more it will be able to develop its activities. This may lead to a discussion over increased funding, in the future. As a

distributed RI, it is essential that DiSSCo ERIC capitalises on the knowledge of its member institutions and encourages the development of Centres of Excellence.

Appendix 1: detailed data from EUROSTAT

All data on GDP, GERD and population size are issued from the EUROSTAT official website: <https://ec.europa.eu/eurostat/fr/> .

Table 9

	Average GERD (M EUR)	Average GERD / cap (EUR / inhabitant)	Average GDP (M EUR)	Average GDP/ cap (EUR/cap)	Average (Population on 1 January - total)
Austria	11 881	1 347	383 935	43 443	8 822 267
Belgium	13 379	1 173	461 249	40 350	11 398 589
Bulgaria	442	63	56 772	8 080	7 050 034
Croatia	509	124	52 716	12 873	4 105 493
Cyprus	136	157	21 721	24 940	864 236
Czechia	3 929	370	210 239	19 777	10 610 055
Denmark	8 905	1 541	302 221	52 177	5 781 190
Estonia	374	283	25 844	18 487	1 319 133
Finland	6 442	1 169	233 207	42 280	5 513 130
France	51 952	775	2 366 061	35 080	67 026 224
Germany	104 749	1 265	3 368 623	40 640	82 792 351
Greece	2 185	203	179 937	16 760	10 741 165
Hungary	1 961	201	136 535	13 967	9 778 371
Iceland	472	1 357	22 110	62 793	348 450
Ireland	3 970	820	327 033	67 200	4 830 392
Italy	25 095	416	1 768 211	29 533	60 483 973
Latvia	173	90	28 939	15 023	1 934 379
Lithuania	430	153	45 567	16 233	2 808 901
Luxembourg	721	1 197	60 221	98 850	602 005
Malta	74	154	12 981	26 673	475 701
Netherlands	16 798	978	775 063	44 963	17 181 084
Norway	7 600	1 435	361 782	68 100	5 295 619
Poland	5 966	157	499 094	12 993	37 972 964
Portugal	2 782	270	205 169	19 937	10 291 027

	Average GERD (M EUR)	Average GERD / cap (EUR / inhabitant)	Average GDP (M EUR)	Average GDP/ cap (EUR/cap)	Average (Population on 1 January - total)
Romania	1 012	52	205 550	10 550	19 533 481
Slovakia	759	139	89 661	16 463	5 443 120
Slovenia	895	432	45 807	22 063	2 066 880
Spain	14 860	318	1 203 955	25 727	46 658 447
Sweden	15 976	1 580	475 856	46 793	10 120 242
Switzerland	19 752	2 328	633 491	74 400	8 484 130
United Kingdom	41 991	634	2 435 767	36 667	66 273 576

Funding program

[H2020-EU.1.4. - EXCELLENT SCIENCE - Research Infrastructures](#) Main Programme

[H2020-EU.1.4.1.1. - Developing new world-class research infrastructures](#)

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Author contributions

Salomé Landel: Writing - original draft (lead); visualisation (lead); conceptualisation (equal); methodology (equal). **Michel Guiraud:** Methodology (lead); supervision (lead); writing – review and editing (supporting). **Gaël Lymer:** Writing – original draft presentation (equal); conceptualisation (supporting). **Markus Pasterk:** supervision (equal); methodology (supporting). **Katharine Worley:** Writing – Review and editing (supporting); investigation (supporting).

Eva Alonso: methodology (supporting); project administration (lead). **Dimitris Koureas:** methodology (supporting); project administration (lead); supervision (supporting). **François Dusoulier:** Writing – review and editing (supporting); conceptualisation (supporting); methodology (supporting). **Ana Casino:** project administration (supporting). **Frederik Leliaert:** Writing – review and editing (supporting); investigation (supporting). **Stefaan Pijls:** Writing – review and editing (supporting); investigation (supporting). **Patricia Mergen:** investigation (supporting); resources (supporting). **Helen Hardy:** investigation (supporting); Writing – review and editing (supporting).

Conflicts of interest

The authors have declared that no competing interests exist.

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