Group of Senior Officials Framework for Global Research Infrastructures and how ELIXIR aligns

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1 Core purpose of Global Research Infrastructures

Global Research Infrastructures should address the most pressing global research challenges, i.e. those frontiers of knowledge where a global-critical-mass effort to achieve progress is required. Science, technology, innovation, construction, upgrading, and termination or decommissioning. Rules for future participation should be defined to allow the inclusion of new partners.

ELIXIR is an intergovernmental initiative that unites Europe's leading life science organisations in managing and safeguarding the increasing volume of data being generated by publicly-funded research. It coordinates, integrates and sustains bioinformatics resources across its member states, and enables users in academia and industry to access services that are vital for their research. These bioinformatics resources include databases, software tools, training materials, cloud storage and supercomputers. The goal of ELIXIR is to coordinate these resources so that they form a single linked infrastructure, thereby enhancing the value of nation-al-level bioinformatics infrastructure and reducing effort duplication. This distributed pan-European infrastructure makes it easier for scientists anywhere on the globe to find and share data (via virtual access), exchange expertise across borders, and agree on best practices (e.g. standards for interoperability).

2 Defining project partnerships for effective management

Global Research Infrastructures initiatives should explicitly and clearly define, as early as possible, the roles and responsibilities of the partners through the different phases of a project's full lifecycle: planning, construction, operation, upgrading, and termination or decommissioning. Rules for future participation should be defined to allow the inclusion of new partners.

The ELIXIR Consortium Agreement is the legal framework behind ELIXIR, and describes its governance structure, along with roles and responsibilities of its Members. ELIX-IR has been a legal entity since December 2013, and is currently implementing its first five-year Programme (2014-2018), whilst preparing the next one (2019-2023). There are currently 21 countries which are Members of ELIXIR, plus the European Molecular Biology Laboratory (EMBL). Cyprus is an Observer. Eligibility and procedure for new countries to join are detailed in the ELIXIR Consortium Agreement and in other practical documentation held by the ELIXIR Hub. Any country in the world can apply to the ELIXIR Board to become a Member or Observer; the Board reviews applications against a set of objective criteria before making a final decision. The ELIXIR Collaboration Agreement is the legal document that ti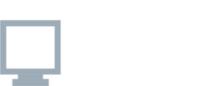es together the ELIXIR "Hub" (i.e. Secretariat) with the national Node in each Member country. This allows the ELIXIR Hub to run Commissioned Services across its Members, in support of implementing ELIXIR's work programme.
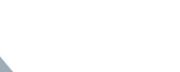
3 Defining scope, schedule, and cost

Stakeholders should agree upon a shared understanding of the project scope (including a timetable) and cost, addressing inherent uncertainties and any external constraints, and define processes to effectively address deviations.

To frame the scope of ELIXIR's activities, the ELIXIR Board, comprising of representatives from the Members, adopts a five-year Scientific Programme and accompanying Financial Plan, setting out the scope and high-level objectives to be achieved in that period. Annual Work Plans and Budgets, within the framework of the Financial Plan and Scientific Programme, then set out in more detail the exact activities that will be carried out by ELIXIR partners, including the Commissioned Services that will be undertaken. The ELIXIR Board meets twice a year to receive a technical and financial update (including on externally funded projects); and to decide on actions to be taken to address deviations. As Membership to ELIXIR is stable, and the budget provided by countries is calculated on the basis of their Net National Income, planning the cost of activities within the five-year period or annually is relatively straightforward. There is less certainty in terms of externally-funded projects as these are dependent on successful peer review and the value of competing proposals.

4 Project management

Appropriate management structures and professional financial management should be established, consistent with best practices derived from existing recommendations and experience at the international level, to ensure rigorous project management.

The ELIXIR Handbook of Operations provides information on the governance structure of ELIXIR, as well as its procedures and policies, notably in terms of project management. The ELIXIR Hub has a team of expert project managers which manage the internally-funded portfolio of projects (called Commissioned Services), as well as the portfolio of externally-funded projects (for instance funded by the European Union), in close collaboration with key technical and administration personnel from the Hub. Key Project MAnagement of Knowledge Areas, as defined by the Project Management Body of Knowledge (i.e. integration, scope, time, cost, quality, human resources, communication, risk, procurement and stakeholder management), are hence taken into consideration. Professional development plans for employees of the Hub are collaboratively defined with their respective line managers, to ensure that work objectives are clear and, where relevant, adequate training is provided. The ELIXIR Hub currently participates in a Joint Masters in Research Infrastructure management through the RITrain project.

5 Funding management

The development of a Global Research Infrastructure should foresee a careful balance between the minimum acceptable percentage of in-cash contributions and the appropriate level of in-kind contributions. The in-kind contributions have to be effectively evaluated regarding quality and schedule.

ELIXIR is funded via (1) Ordinary Contributions from Member States in line with Net National Income, and (2) competitive, fixed-term grants such as from the European Union's Horizon 2020 Programme and the Innovative Medicines Initiative. A proportion of ELIXIR's income is spent on administrative costs (staff time, travel and other expenses, overheads, ad-hoc consultancy support), but the majority of the ELIXIR Budget is allocated to technical activities delivered by Nodes via Commissioned Services. Hence, the costs of ELIXIR are mainly operational, rather than related to the construction and maintenance of a physical infrastructure. The ELIXIR Budget excludes in-kind contributions (e.g. in terms of staff time) from scientists who are implementing the Scientific Programme via Nodes. The activities that connect these services in the Nodes are regularly reviewed by the ELIXIR Scientific Advisory Board, firstly when a country joins and a Node application is submitted, and periodically thereafter. This ensures that ELIXIR reviews only focus on the activities that are within the scope of ELIXIR. The upcoming ELIXIR Programme for 2019-2023 will include a mid-term review, which will be carried out by independent and leading international experts in bioinformatic science, as well as research infrastructure operations. In terms of external funding, all grants such as those under European Union's Horizon 2020 Programme, require periodic and final reviews by external evaluators. Finally, ELIXIR's accounts are monitored internally as part of the bi-weekly management team meetings, with corrective actions taken as necessary. Accounts are also externally audited and presented to the ELIXIR Board for yearly approval.

6 Periodic reviews

The scientific output and strategic goals of Global Research Infrastructures should be established, consistent with best practices derived from existing recommendations and experience at the international level, to ensure regular and periodic evaluation and updated if needed throughout the entire lifecycle to ensure consistent excellence of the scientific output. In addition, an assessment of the quality of the services offered to the scientific communities is necessary to ensure the long-term usefulness and success of the infrastructure. Partnership agreements among funding agencies must enable each nation to fulfil its unique stewardship responsibilities on behalf of its national government for oversight of contributed funds.

ELIXIR follows a "Hub and Nodes" model in which the Hub coordinates the work across ELIXIR, whilst each Member country hosts a Node made of a network of organisations that provide the services accessed by users. The individual resources run by Nodes are typically funded nationally, and hence have their own review processes, including through independent, international scientific advisory boards. The activities that connect these services in the Nodes are regularly reviewed by the ELIXIR Scientific Advisory Board, firstly when a country joins and a Node application is submitted, and periodically thereafter.

7 Termination or decommissioning

Planning for termination or decommissioning of a Global Research Infrastructure initiative should be established early in the development of the facility where possible or relevant, by defining criteria for the conclusion of operation, and establishing exit criteria and procedures for closing down and recognizing future termination liabilities or encumbrances on the sponsors at the conclusion of operation.

ELIXIR's portfolio of technical activities scales with the organisation's membership size, as the activities aim to coordinate and link national-level research infrastructures. More generally, ELIXIR will continue to operate a long as it brings value to its Members - demonstrating impact, especially socio-economic impact, underpins ELIXIR's sustainability in the long-term. ELIXIR Members remain as such unless they withdraw from the ELIXIR Consortium Agreement, and we are currently working on drafting a decommissioning plan that will be incorporated to our Risk Management Plan.

8 Access goal based on merit review

The GRI policies should reflect the global-Excellence-driven Access (i.e. a paradigm through publication of a clear and transparent access goal. The goal should incorporate a peer-reviewed process that recommends access based on the most promising emergent ideas, irregardless of the country of origin or the ability of the proposer to contribute financially.

As an 'Open Data' infrastructure, ELIXIR's resources are available to all users, regardless of their location or sector, and via the virtual access modality (i.e. web-based access). There is no generic nor formal access review process whereby users apply for access to the ELIXIR's resources. Rather, users anywhere on the globe typically go directly to the website of the resource which they wish to use (often this is known to them), or find a resource through one of the registries (e.g. the TeSS Training Portal for training materials discovery; BioTools for finding software and analysis tools). A full list of ELIXIR's resources can be accessed on a dedicated page of the web site. Notable exceptions to the open access approach include "access controlled" databases of sensitive human data for which a Data Access Committee reviews the proposed experiment, or access to cloud facilities where users may need to submit a proposal to access the computing resource.

9 E-infrastructure

Global Research Infrastructure initiatives should recognize the utility of the integrated use of advanced e-infrastructures, services for accessing and processing, and curating data, as well as remote participation (interaction) and access to scientific experiments.

ELIXIR is a virtual and distributed infrastructure: its resources (from databases and software tools, to training materials, cloud storage and supercomputers) are, by definition, available via web-based access and therefore it could be described as an e-infrastructure for the life sciences. ELIXIR's activities are divided into four areas called 'Platforms': Data, Tools, Interoperability, Compute and Training. These Platforms work in close collaboration with ELIXIR 'Communities', which bring together experts to develop standards, services and training within specific life science domains (e.g. Human Data, Rare Diseases, Marine Metagenomics, Plant Sciences, etc).

10 Data management

Many Global Research Infrastructures have recognised the data management needs by providing advice, hands-on support, training and consultancy, along with running a number of services related to data management. For instance, ELIXIR has compiled a list of resources that it recommends for the deposition of experimental data: the ELIXIR Deposition Databases; this list is referenced in guidance from the European Research Council. In terms of interoperability, ELIXIR helps users and machines to discover, access, integrate and analyse biological data, by encouraging the life science community to adopt standardised file formats, metadata, vocabularies and identifiers, in line with recommendations from the Research Data Alliance and other international initiatives. Additionally, in ELIXIR Nodes typically help to make the industry-generated data "FAIR" (i.e. Findable, Accessible, Interoperable and Reusable), to help with making these data available to all ELIXIR has also established a Bioinformatics Supplier's Forum, to allow for collaboration between ELIXIR experts and industry providers of bioinformatics services such as High Performance Computing, hardware and software.

ELIXIR Nodes support life scientists with their data management needs by providing advice, hands-on support, training and consultancy, along with running a number of services related to data management, For instance, ELIXIR has compiled a list of resources that it recommends for the deposition of experimental data: the ELIXIR Deposition Databases; this list is referenced in guidance from the European Research Council. In terms of interoperability, ELIXIR helps users and machines to discover, access, integrate and analyse biological data, by encouraging the life science community to adopt standardised file formats, metadata, vocabularies and identifiers, in line with recommendations from the Research Data Alliance and other international initiatives. Additionally, in ELIXIR Nodes typically help to make the industry-generated data "FAIR" (i.e. Findable, Accessible, Interoperable and Reusable). Finally, a dedicated working group on data management, to promote exchanges of best practices across ELIXIR Nodes, is also in place.

11 Clustering of Research Infrastructures

Where clustering of complementary Research Infrastructures appears to be consistent with the mission of the Global Research Infrastructure, schemes for access and mobility of researchers, engineers and technicians through the cluster should be actively encouraged.

ELIXIR collaborates closely with other European-wide research infrastructures and e-infrastructures, in particular research infrastructures linked to ESFRI (European Strategy Forum on Research Infrastructures). These collaborations are often facilitated by ELIXIR's participation in, and/or leadership of, European Union funded projects such as CORBEL (Coordinated Research Infrastructures Building Enduring Life-science Services). ELIXIR's activities and collaborations of international (i.e. beyond Europe) relevance are described in its International Strategy. In this context, ELIXIR has established formal agreements with many international bioinformatics-related initiatives. For instance, it collaborates with the Global Alliance for Genomics and Health (GA4GH) in developing and promoting standards and frameworks for the responsible sharing and reuse of genomics data.

12 International mobility

Measures to facilitate the international mobility of scientists and engineers to participate in Global Research Infrastructures should be promoted.

Since 2017, ELIXIR has been running a Staff Exchange Programme aiming to support capacity building in ELIXIR Nodes, and the exchange of best practices in bioinformatics service provision. To date, a total of nine projects have been funded under the first call (2018), with approximately 30 mobilities. The programme is currently limited to Members of ELIXIR, hence only countries that join ELIXIR can take part. However, from 2019, there will be two calls per year, and eligibility will be expanded to allow for staff exchanges with industry. Additionally, many ELIXIR Nodes utilise the Marie Skłodowska Curie RISE (Research and Innovation Staff Exchange) scheme - a dedicated European Union Horizon 2020 funding scheme for international staff exchanges - to allow them to exchange staff with international partners.

13 Innovation, Technology Transfer and Intellectual Property

Global Research Infrastructures should develop policies with clear goals and strategies for the promotion of innovation and technology transfer and the management of intellectual property. These policies should recognise the differing opportunities for innovation at each lifecycle stage as well as the barriers and drivers appropriate to the particular GRI context. GRI's are encouraged to regularly exchange information on good practices regarding: (1) innovation and intellectual property rights management; and (2) the sharing, exploitation and utilisation of data and technologies generated by usage of the GRI.

ELIXIR's Industry Strategy presents a comprehensive overview of the current and future actions that ELIXIR aims to carry out to stimulate innovation and ensure industry uptake of ELIXIR's services. This Strategy, which benefits from high-level strategic guidance from ELIXIR's Industry Advisory committee, aims to increase industry usage of ELIXIR resources, as well as fostering open innovation of European Small and Medium-sized Enterprises (SMEs). Several communication channels including newsletters, online surveys, and industry-focused events organised by ELIXIR are used to implement the Strategy, and monitor its impact. To further promote the reuse of public-funded data research infrastructures for data-driven innovation, a report describing this entrepreneurial ecosystem, including success stories of companies in this sector, is regularly published. We actively collaborate with the industry via Innovative Medicines Initiative (IMI) grants from the European Union, in which ELIXIR Nodes typically make the industry-generated data "FAIR" (i.e. Findable, Accessible, Interoperable and Reusable).

14 Monitoring socio-economic impact

The socio-economic impact and knowledge transfer issues of Global Research Infrastructures should be assessed not only in the beginning but during the lifecycle of the project. The GSO will refer also to the OECD Global Science Forum work on the socio-economic impact of Research Infrastructure.

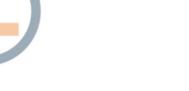Research infrastructures underpin access to life science data and the various services derived from them. These infrastructures are critical to bioinformatics research and its many applications in the fields of health (e.g. personalised medicine), food security (e.g. aquaculture) and the environment (e.g. pollution remediation), which are of significant societal and economic benefits. Impact assessment, particularly socio-economic impact, is an emerging and developing area of work across ELIXIR. One of the most active ELIXIR members in this area of work is the European Institute for Bioinformatics (EBI), based in the UK, and part of the European Molecular Biology Laboratory (EMBL). In 2016, UK-based consultancy Charles Beagrie Ltd published an in-depth analysis of the value and impact of EMBL-EBI, with the report valuing the benefits to users and their funders at £1 billion per annum worldwide - equivalent to more than 20 times the direct operational cost of the institute. Further to this, the RI-PATHs project ('Research Infrastructure imPact Assessment paTHways'), funded by the European Union under the Horizon 2020 aims to develop a common methodology for assessing the socio-economic impact of research infrastructures, with ELIXIR as one of several case studies not restricted to life sciences. Finally, the ELIXIR Hub has bee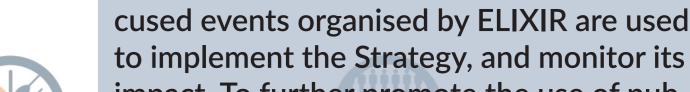n actively promoting the work of the Organisation for Economic Co-operation and Development (OECD), in the context of their efforts to develop a methodology that can be applied to all research infrastructures, to assess their socio-economic impact.