Science Europe Roadmap

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SCIENCE EUROPE
Shaping the future of research

Science Europe Roadmap

Contents

PART I

Vision and Overview

Science Europe

Science Europe is an association of European Research Funding and Research Performing Organisations, founded in 2011, with the aim of promoting the collective interests of Members and facilitating collaboration at policy, funding and performing levels.

Individually, the Science Europe Member Organisations are independent major research organisations, with significant national impact. Collectively, the Members work across all research fields and manage a substantial proportion of public research investment in Europe; with this budget responsibility comes substantial policy impact. Science Europe is a key platform for collaboration and an important voice in the EU research policy debate, acting as a 'third voice', alongside national governments and European Union institutions. The membership of Science Europe is committed to shaping the future of research.

Science Europe ensures that the voice of active scientists is heard in this policy debate, through its six Scientific Committees. Comprising influential researchers from across Europe, the Committees cover all scientific and scholarly domains, including the social sciences, arts and humanities.

Science Europe Vision

The ultimate mission of Science Europe is to facilitate collaboration of its Members, in order to contribute to the design and development of a strong and effective European research system. Science Europe builds on its Member Organisations' experiences and expertise in funding and performing excellent research across all domains, and develops collective approaches when and where these add value to individual activities. Striving for 'better science' underpins all activities and positions.

To achieve this vision for a strong and effective research system, Science Europe's activities will focus on four strategic objectives:

- **Supporting 'borderless science'** – ensuring that researchers and research organisations can collaborate at the level of projects, programmes and facilities.

  This collaboration must be driven by scientific need, and must not be hampered by administrative obstacles or by lack of information. A scientific environment without geographic, disciplinary or sectoral borders requires enhanced collaboration, mobility and interdisciplinarity. It is necessary to maximise cross-border collaboration, and to optimise collaborative approaches to research infrastructures of all types. The sound creation and circulation of knowledge also necessitates closing the gap between stronger and weaker European research systems, through appropriate measures dedicated to capacity building. Special attention to mobility, Open Access to publications, access and preservation of data and cross-border collaboration mechanisms, among others, is needed in order to achieve this. Furthermore, there is a need to create incentives for, and reduce the burdens of, co-operating internationally beyond Europe. It is important for Science Europe Member Organisations to have a mutual understanding of their respective international co-operation strategies, with a view to exchanging good practice and exploring possible synergies.

- **Improving the scientific environment** – ensuring that research careers are facilitated and research institutions strengthened.

  This will ensure that excellent scientists, research administrators and science policy makers can reach their full potential, in an environment in which they are fully supported. It includes striving towards gender equality and addressing other diversity issues, supporting the most robust approaches to research integrity, and capacity building in regions with less developed research systems. Effective, efficient and high-quality peer review is at the heart of the scientific system, and is a prerequisite for the funding and performance of excellent research.

- **Facilitating science** – ensuring the efficiency and effectiveness of the research system, and fostering research potential.

  This requires developing and implementing state-of-the-art peer-review processes, strengthening the analysis and *ex-post* evaluation of research programmes and policies, and horizon scanning for new and emerging topics and trends. Both excellent basic and applied research are essential components of an effective innovation system, and mechanisms for selection and evaluation must ensure their quality, including by accommodating interdisciplinary approaches. Science Europe Member Organisations have extensive experience that can be used to support scientific excellence, promote collaboration, build capacity across Europe, encourage interdisciplinary research skills through appropriate education and training, foster world-class pan-European research infrastructures, and improve working conditions for researchers.

- **Communicating science** – ensuring that research results are utilised in the best way possible, both within and beyond scientific communities.

  This involves increased knowledge sharing, for example via Open Access to research publications. It also involves a dialogue between science and society, the support and promotion of public engagement in science, and a common understanding of the impact of publicly-funded research. Science Europe Member Organisations have a specific role in funding and performing research, even when societal impact is indirect, long-term or hard to quantify. Science Europe also has a role in informing debate and advising policy makers, based on a clear mandate from its Member Organisations and the expertise of its Scientific Committees. Such advice must be evidence-based, and must stem from a thorough consideration of both current policies and potential new directions. It is essential to assess the state-of-play in each area, in order to identify appropriate forward-looking activities, which involve all relevant parties. It is also essential that the outcomes of horizon scanning and policy foresighting work are effectively disseminated, through position statements, recommendations or other means.

These inter-related strategic objectives require both policy co-ordination and concrete action, recognising and building on the considerable progress that has been made in many of these areas in recent years. This progress includes the work undertaken through the ESF-EUROHORCS 'Vision for a Globally-competitive ERA and Roadmap for Actions'. Science Europe's vision and proposed actions build on this early and innovative ERA action plan, acknowledging the important foundational work done by all those involved in implementing this.

The European Research Area

An explicit and central mission of Science Europe is to contribute to strengthening a European Research Area (ERA). The ERA initiative promoted by the European Commission aims at realising a 'fifth freedom'; that is, establishing a coherent policy framework and removing the main barriers to free movement for researchers and knowledge in Europe.

Science Europe's vision is that the ERA is a research environment that is evolving, dynamic, flexible, attractive, creative and competitive on a worldwide scale; it is a long-term project, and to strive for its 'completion' would be to lack ambition. Progress towards ERA requires input from a wide range of stakeholders, and will be dependent on the development of mutually-beneficial relationships, built, critically, on trust. On this basis, exciting opportunities for further research collaboration will develop and Science Europe aims to play a leading role in these.

Science Europe is already working towards ERA objectives, both independently and in partnership, including in the context of the 'Joint Statement on Working in Partnership in Achieving the European Research Area' (17 July 2012).

Science Europe's priority actions support efforts to strengthen Europe's research systems, including but not limited to those identified in the context of the European Commission Communication 'A Reinforced European Research Area Partnership for Excellence and Growth' (COM(2012) 392 of 17 July 2012). The Organisations which form Science Europe have been part of the back-bone of the European research landscape for decades. In the interests of scientific progress and competitiveness they interact, collaborate and contribute naturally to a genuine European Research Area, through action within their remits and competences in all areas identified in this Roadmap.

In addition to efforts made at the national level, Horizon 2020 – the EU Framework Programme for Research and Innovation (2014-2020) – will be an important instrument to contribute to ERA, and therefore engagement with it is crucial. Science Europe is committed to following the development and implementation of Horizon 2020, and to contributing to policy discussions surrounding this. This includes producing positions and responses where there are issues on which Member Organisations have a clear and common view.

Through its six discipline-specific Scientific Committees, Science Europe has essential expertise in all Societal Challenge areas of Horizon 2020, and offers this expertise to contribute to both debate and programme development.

The Roadmap

This Roadmap, approved by the Science Europe General Assembly on 21 November 2013, constitutes Science Europe's action plan to contribute to the elements of a successful research system, as set out above. It acts as a framework for voluntary collective activity, providing a long-term strategy, which will be reviewed regularly and updated as the research landscape, and Science Europe itself, evolves.

The Roadmap identifies the following nine Priority Action Areas:

- Access to Research Data
- Cross-border Collaboration
- Gender and Other Diversity Issues
- Open Access to Research Publications
- Research Careers
- Research Infrastructures
- Research Integrity
- Research Policy and Programme Evaluation
- Science in Society

The Priority Action Areas identified in the Roadmap are those in which Science Europe Member Organisations believe that there is potential to achieve tangible and substantive progress, and to add real value by working together. Achieving results will involve recognising and capitalising on the diversity that exists across the Membership, and indeed across Europe, as well as by fostering joint approaches where it is appropriate to do so.

A robust research system for Europe can only be ensured if all actors play their part in this, including national governments, European institutions, individual organisations and researchers themselves. Science Europe is committed to working in dedicated areas, within the collective remit of its Member Organisations and the scientific communities they represent, as well as collaborating with others where partnership is needed and where progress requires effort beyond that of Members.

Roadmap Implementation

Much of the work towards achieving the objectives set out in the Priority Action Areas of this Roadmap will be taken forward by Science Europe **Working Groups**. Policy actions not specifically addressed by Working Groups will be pursued centrally by the Science Europe Office, or individually or collectively by Member Organisations. This will ensure that concrete action is taken by those who have the necessary experience and mandate to make real progress.

Each Working Group will comprise expert individuals from within Science Europe Member Organisations and will operate on the basis of a two-year mandate, which may be renewable following a review of achievements and priorities at the end of the term. Working Groups have two-year work plans containing specific and measurable milestones and deliverables directly linked to the Roadmap objectives.

When newer areas of collaboration between Members are identified, a **Task Force** may be established to scope further action by Science Europe. A Task Force will have an exploratory function for a limited duration. It may be the case that a Task Force recommendation leads to the creation of a new Working Group; alternatively, it might recommend the embedding of activities in one or more existing Working Groups.

All proposals for Task Forces or Working Groups are considered and approved according to the Science Europe Articles of Association and Internal Regulations.

The actions taken to pursue the objectives laid out in this Roadmap are directly informed by the scientific community, represented by the six Science Europe **Scientific Committees**, whose members are independent scientists. The Scientific Committees will provide advice and complement the work of the Working Groups and Task Forces on Roadmap topics in the context of their domain, as set out in their own work plans. The interface between the Working Groups, Task Forces and Scientific Committees will be facilitated by the Science Europe Office in order to address, as appropriate, the specific needs and requirements of different scientific communities.

Monitoring Activities

Member Organisations believe that an evidence-based approach is essential in all Science Europe activities, including those related to establishing the ERA. Therefore, a central component of every Priority Action Area of the Science Europe Roadmap will be evidence gathering, monitoring and reporting.

For each Priority Action Area where a dedicated Working Group has been set up, the Working Group will:

- Establish the current 'state of play' within the Science Europe membership on key topics, as identified in their work plan;
- Assess the impact of actions and recommendations of other Working Groups on their policy area, and provide input to these when requested;
- Regularly review progress against the objectives outlined in the work plan; and
- Communicate outputs resulting from their actions, including evidence-gathering activities where appropriate and relevant.

In each individual action area Science Europe will carefully consider what constitutes success, recognising that there is rarely a 'one size fits all' solution to identified challenges.

Science Europe will develop an appropriate central monitoring mechanism to facilitate this endeavour.

Roadmap Review

This Roadmap constitutes a long-term vision and strategic plan for Science Europe.

In addition to the regular evaluation of the individual activities, as detailed above, the Roadmap itself will be periodically reviewed to ensure that it adequately reflects the members' vision of the organisation within a changing political context.

PART II

Priority Action Areas

The following section highlights nine Priority Action Areas, which together constitute the main policy priorities for Science Europe.

Each Priority Action Area is structured around:

- An overview of the issue and the research policy context; and
- Objectives for future activities of Science Europe.

Access to Research Data

Enhanced research data policies will contribute to:

- **Supporting borderless science** – by making cross-border and interdisciplinary collaboration easier; and
- **Facilitating science** – by accelerating R&D processes and making them more cost effective, and by increasing the chances to yield unexpected outputs from data collections.

What is the Issue?

Quality-assured research data are key building blocks of the research process, and are the basis of economic and societal innovation. Research data often generate impact that goes well beyond their initial purpose. They are highly valuable in terms of supporting new research. They are also indispensable in verifying research findings, and in this way the sharing of data contributes significantly to good scientific practice. The collection of research data can be a major part of a research project, and the wider sharing and re-use of this data can help to maximise the value of the original investment.

Research data is understood here as a broad concept embracing a variety of factual material, such as numerical data, text, video and audio materials. Research data should be permanently, publicly and freely available for re-use. However there may be legitimate reasons (including discipline-specific ones or privacy related ones) for delayed or restricted access, which call for a balanced approach towards openness to research data.

Making research data available also requires explanatory information (metadata), and in some cases data-specific software and analytic models in order to facilitate reproduction and re-use. There is a need to develop an ecosystem of computational solutions and information technology, enabling easier cross-border and interdisciplinary collaboration, and explicitly recognising discipline-specific particularities. Such an ecosystem would allow the production of new data and the processing of the enormous amount and variety of data produced every day, thus allowing data-driven discovery to take place. Text and data mining techniques are now greatly enhancing the potential for (re-)analysing research data, accelerating research processes and enabling new findings. Open standards, formats and open-source software solutions can all help to facilitate the necessary technical developments.

All data should be appraised for digital curation, in order to achieve an appropriate relation between effort and benefit. There may well be cases where data can be reproduced later at a lower cost than that of preservation, and perhaps even with higher quality. However, in many disciplines there are data from observations, tied to a point in time, which cannot be repeated and must therefore be preserved.

Whilst the re-use of research data has always been a key factor in scientific co-operation, there are still a number of real and perceived barriers, including legal, technical, financial, trust-related and socio-cultural ones, which can hamper the wider sharing, discovery and re-use of research data and re-analysis of existing content.

Increasingly, data from government agencies, patient (health) data and proprietary data, both commercial and non-commercial, are of crucial interest in research. A balance of all ethical considerations must be found to ensure trust amongst all stakeholders, including the public and researchers themselves. It is essential that privacy, confidentiality and consent are respected, whilst the best possible level of access is provided in order to maximise opportunities for new research, and to enable scrutiny and reproducibility of research.

It will be beneficial to the advancement of research, and ultimately to the European taxpayer, to address common issues in relevant policies and funding structures globally, or at least Europe-wide. Science Europe Member Organisations have already issued a number of general principles, policies and detailed requirements related to research data. They have proposed best practices related to data management, and have identified how the absence of such measures can lead to scientific misconduct. They fund and routinely operate elaborate data infrastructures in an increasing number of fields.

Science Europe's Objectives

Science Europe Member Organisations acknowledge that open data should be the standard, whilst recognising that this can be postponed or limited if there is legitimate reason to do so. They will engage in a process, along with other stakeholders in Europe and beyond, to determine adequate practices for the preservation of research data and conditions governing their re-use.

Science Europe will:

- Promote the importance of data sharing principles – in reflecting the needs of the various disciplines, and in generally furthering research and innovation to gain maximum societal benefit – as well as guiding the definition and implementation of consistent data-sharing policies and practices;

- Contribute to the establishment of an 'ecosystem' of globally and disciplinarily interoperable, trustworthy and sustainable research data infrastructures, and explore appropriate funding structures adapted to national and organisational capabilities;

- Foster the development of relevant training and career paths, acknowledging that data-intensive research requires new and additional types of skill;

- Collaborate in developing appropriate incentive measures for scientists to archive and share their data, by promoting data management plans and support for research data collection;

- Advocate that data and scientific software contributions are treated as valuable research outputs and should play a significant role in the evaluation of research;

- Seek clarity on the legal conditions framing the envisaged re-use of research data and the possible harmonisation and changes necessary to realise this; and

- Identify where protected environments, or 'safe havens', for data are necessary, and promote the creation of policies, technical concepts and, ultimately, safe infrastructure for such cases.

Cross-border Collaboration

Enhanced cross-border collaboration policies will contribute to:

- **Supporting borderless science** – by helping policy makers to provide better framework conditions for cross-border collaboration, by supporting the co-ordination of funding from different sources, and by bringing about the easier mobility of funds and researchers;
- **Facilitating science** – by ensuring that collaboration patterns are driven by scientific content rather than administrative requirements; and
- **Improving the scientific environment** – by developing lighter administrative procedures for researchers.

What is the Issue?

Scientific research is not bound by national borders. Indeed, international co-operation, both within and outside of Europe, has always been part of the European scientific landscape; cross-border collaboration is a reality, and takes place every day across the globe. For Research Performing and Research Funding Organisations, collaboration across borders is not defined as an end in itself, but rather by the scientific added value that it produces. Science Europe Member Organisations share an ambition to support excellent science. This requires allowing their research communities to work in the most productive national and international configurations, in order to address research challenges and to support less research intensive regions. Increased collaboration across borders should not mean increased administrative burden for researchers. However, cross-border collaboration often requires funding support from more than one country, or for research funds to cross borders, and this can be operationally challenging to manage.

For the benefit of research and researchers, Science Europe Member Organisations establish systems that are flexible enough to support collaboration, and to ensure that research projects are not hindered by the mobility of a funding beneficiary. The core issue is to ensure that there are no excessive barriers to the support of cross-border research, and that public funds are used as efficiently as possible. Mechanisms for collaboration should be simple at both the conceptual and operational levels. In addition, the potential added value of co-financing research across countries and research organisations needs to be fully assessed and communicated.

There is currently a varied picture across Europe regarding the definitions and conditions of the different collaborative mechanisms. A clear and shared understanding of the rationale and potential benefits – and of the practical implications – of each of the models of collaboration is needed, in order to help build trust among research organisations.

Leading Research Funding and Performing Organisations in Europe have already developed a concept for increased cross-border collaboration. As part of this concept, a number of models, mechanisms and instruments have been implemented to allow researchers to take the remainder of a grant with them if they move to another country (Money follows Researcher); to allow part of a grant to be used to fund participation of a researcher from another country (Money follows Co-operation Line); and to allow researchers to avoid

'double jeopardy' in bilateral or multilateral co-operation through management of the peer review process by a single agency (Lead Agency Procedure). Numerous other bilateral and multilateral collaboration models exist, such as the Open Research Area (ORA), which allows multilateral social science project proposals within a joint peer-review process.

In cases where these instruments have been applied they have been largely successful. They have contributed to an increasing body of direct experience for the research organisations involved, which will help to guide future approaches.

In addition, cross-border collaboration is facilitated by European-level initiatives to co-ordinate national research agendas, such as ERA-NETs and joint programming. Such initiatives demand co-operation between national organisations and can complement the mechanisms which are being set up by Science Europe Member Organisations.

Science Europe's Objectives

Science Europe Member Organisations are committed to promoting an open environment for research co-operation, as well as mutual learning, a better understanding of practices, and the strengthening of the linkages between diverse national research systems in Europe.

The ultimate goal is to establish a modular approach to supporting cross-border collaboration. Science Europe will further develop this concept by facilitating joint definition, understanding and uptake of its mechanisms. Priorities will be to:

- Inform the policy debate with evidence and advice;
- Facilitate effective implementation of the Money follows Researcher model;
- Identify and disseminate good practice for Money follows Co-operation Line models;
- Identify and disseminate good practice in implementing the Lead Agency Procedure, and providing guidance on operational issues, including consideration of high standards of peer-review;
- Collect further evidence of good practice in the management and implementation of cross-border collaboration in research;
- Share experience and perspectives in order to develop common approaches to cross-border collaboration between Research Performing Organisations; and
- Exchange good practice and institutional strategies regarding European multilateral mechanisms for cross-border collaboration and other ways of implementing bilateral and multilateral collaborations.

Gender and Other Diversity Issues

Enhanced policies related to gender and diversity issues will contribute to:

- **Facilitating science** – by increasing the effectiveness of R&D programmes and widening the talent base available to the science base; and
- **Improving the scientific environment** – by improving career development opportunities for all.

What is the Issue?

In order to be able to adequately address societal challenges, Europe needs talented researchers, and these must be recruited in a globally-competitive market. Europe must realise the full potential of individuals in research regardless of their gender, sexual orientation, age, religion, disabilities, ethnic origins, or social background. Consequently, European organisations need to define and champion diversity and to promote equality of opportunity for all; this will give every current and future researcher, in particular female researchers at all levels, the chance to achieve their potential, free from prejudice and discrimination.

Increased diversity in research teams correlates positively with the quality of research, partly because diverse teams produce a greater variety of ideas. This holds for gender, but also for under-represented and disadvantaged groups. A wider pool of researchers can be a major resource for scientific excellence.

Gender bias in science has been evidenced through numerous studies. It is clear that it directly disadvantages women, in terms of their unequal participation in decision-making, insufficiently-inclusive policies and processes in some areas of study and funding, and the prevalence of 'the male' as the norm in scientific knowledge and methods. This ultimately disadvantages everyone, and society in general.

Gender and diversity are interwoven with all aspects of research. Researchers, science managers and policy makers have made good progress in advancing excellence through greater awareness of the role of gender and diversity as a dimension of research content, and as an important driver to nurture talent, and to enable knowledge creation and circulation.

Gender and diversity issues in research have gained increased recognition on policy agendas at national, European and international levels, as well as within research organisations. However, the persistence of bias and lack of diversity remain common challenges, and these need to be confronted at all levels.

Science Europe's Objectives

Science Europe will seek to foster necessary structural change in research organisations, with a particular emphasis on the sharing of practice, as well as the need for a realistic assessment of what is effective in different national contexts and whether the practice is transferable. A critical appraisal of existing examples of actions, in terms of their wider applicability, will be necessary, especially with regards to the areas outlined below. Science Europe will aim to harness the expertise of its Member Organisations, in order to provide consolidated contributions to the on-going debate on gender and diversity issues, at national, European and international levels.

This will be achieved through the following actions:

- Science Europe Member Organisations, as employers, have the responsibility to set goals and establish plans to achieve gender equality and equal opportunities for all members of staff and all governance bodies. Science Europe will encourage the establishment of action plans, along with the appropriate measures and resources, to improve the recruitment, retention and career progression of all scientists.

- Science Europe Member Organisations, as funders, have the responsibility to scrutinise the peer review process and to identify any sources of bias that may systematically disadvantage women or members of minority or oppressed groups. Science Europe will promote the development of dedicated training of review panels on the risks of bias when assessing scientists and their work. Recruitment of peer reviewers, drafting and communication of calls for proposals, evaluation criteria and procedures must all be considered.

- Science Europe will promote policy and research initiatives to achieve gender balance. Monitoring the impact of funding instruments on recruitment and gender balance at both junior and senior levels is crucial for providing recommendations. Science Europe will take the initiative in facilitating the sharing of good practice, especially regarding collection of evidence and design of indicators, with the aim of improving the involvement of all excellent researchers in appropriate schemes and initiatives.

- Science Europe Member Organisations, as knowledge providers, have the responsibility to see that a gender and diversity dimension is integrated into the design, implementation and content of research, and to encourage others to do the same.

Open Access to Research Publications

Enhanced policies on Open Access to research publications will contribute to:

- **Supporting borderless science** – by making cross-border and interdisciplinary collaboration easier;
- **Facilitating science** – by promoting and accelerating more efficient and cost-effective R&D processes, and by increasing the opportunities to yield unexpected outputs from past findings;
- **Improving the scientific environment** – by increasing author visibility, thus contributing to the career development of researchers; and
- **Communicating science** – by increasing opportunities for knowledge application, and by fostering a culture of openness in the public sector.

What is the Issue?

Research publications are one of the main results of the research process. It is crucial to move to a system of Open Access, in order to increase both the impact of publications and the cost efficiency of the publication system. In line with the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (22 October 2003), Open Access is defined here as unrestricted, online access to scholarly research publications (including books, monographs and non-traditional research materials) for reading and productive re-use, not impeded by any financial, organisational, legal or technical barriers. Ideally, the only restriction on use is an obligation to attribute the work to its author.

Science progresses where knowledge is shared, and accelerating the sharing of knowledge accelerates the advancement of research. Open Access facilitates and increases the sharing of knowledge within scientific communities and also across sectors, leading to increased returns for taxpayers' money. It improves the pace, efficiency and efficacy of research. It heightens the authors' visibilitiy, and therefore the potential impact of their work. It removes structural and geographical barriers that hinder the free circulation of knowledge, contributing to increased collaboration, and ultimately strengthening scientific excellence and capacity building. Realising this potential requires a holistic view, given the links between Open Access and other aspects of the research process, such as research careers, evaluation, project design and data collection.

Open Access benefits not only the research community, but also the economy and society as a whole. Full access to research results strengthens the dissemination, testing and uptake of scientific breakthroughs. Open Access enables re-use and computational analysis of published material, sparks innovation, and facilitates interdisciplinary research as well as scholarly exchange on a global scale.

Science Europe Member Organisations, as research funders and performers, have the knowledge and capacity to have a real impact on the adoption of Open Access as the standard mode of publication for the results of publicly-funded research. Moreover, openness is increasingly regarded as a guiding principle for the public sector, and Open Access plays a central role in this, as well as in communicating science. Individual Research Funding and Performing Organisations in Europe have already put in place, or are in the process of developing,

Open Access policies, and are engaging with the research community and a wide range of stakeholders to support Open Access.

Open Access repositories and related facilities are key strategic research infrastructures, and universities, as well as research organisations, are committed to improving their interoperability. New Open Access journals are being established as funder-researcher collaborations; these are leading the changes in scientific publishing and showcasing innovation in research communication. Research organisations also support Open Access publishing by establishing and managing Open Access funds. For example, some Research Performing Organisations have institutional memberships with Open Access publishers to cover their authors' fees, and many Research Funding Organisations are prepared to cover Open Access fees in grant agreements.

Science Europe's Objectives

The overall objective remains to move from a subscription-based 'reader pays' system to different business models for research publications. The transition to Open Access has gathered pace in recent years and is a fast-moving process, characterised by constant new technical and policy developments. Science Europe Member Organisations have agreed to a common set of principles for the transition to Open Access to research publications. Based on this common set of principles, and in co-ordination with all Member Organisations, Science Europe will engage in the debate with relevant stakeholders. The common approach to the transition to Open Access taken by Science Europe Member Organisations supports completion of the transition in the most effective and efficient way, whilst allowing enough flexibility to adapt to new developments.

Science Europe Member Organisations will co-operate by taking action in areas that include:

- Supporting the transition to Open Access according to the principles agreed by the Science Europe Member Organisations in the Science Europe Position Statement 'Principles for the Transition to Open Access to Research Publications' (April 2013);
- Defining models that allow the re-direction and re-organisation of resources, in order to replace the current subscription system;
- Engaging with relevant stakeholders in order to define and obtain the best possible terms for access to publications, including use and re-use;
- Incorporating appropriate Open Access provisions into guidelines for funding;
- Looking for solutions that assist authors in openly sharing their research results, where funding to cover expenses for Open Access publications might not be readily available;
- Raising awareness and providing guidance to researchers on how to comply with Open Access policies, especially on managing their intellectual property rights to ensure Open Access to their publications;
- Addressing possible impacts of the transition to Open Access on other aspects of the research process, such as data collection and project design, peer review and evaluation, and research careers; and
- Creating incentives for researchers to participate in the culture of sharing the results of their research.

Research Careers

Enhanced research careers policies will contribute to:

- **Supporting borderless science** – by facilitating appropriate and added-value mobility of researchers;
- **Facilitating science** – by fostering quality and efficiency through improved mobility and increased complementarity between national and European activities, and by securing a wider talent base for the research system; and
- **Improving the scientific environment** – by supporting the enhancement of conditions for researchers.

What is the Issue?

The topic of 'research careers' encompasses all factors related to the conditions under which researchers pursue their professional endeavour. The creation of optimal career conditions requires ensuring that the highest standards in all human resources-related issues are applied wherever researchers are professionally active. These include recruitment processes, career progression at all levels, and equality of opportunity regardless of gender, ethnicity or other differences. In addition, research careers are increasingly diverse and do not necessarily follow traditional paths; these changes require consideration and subsequent action.

In order to ensure the vitality of the European research system, new generations of talented people must be attracted into research professions. This can be done at the level of early-career researchers, by offering them excellent training, by supporting them at the post-doctoral stages and when undertaking high-risk projects, and by ensuring that their autonomy is safeguarded. Europe also needs to prove itself attractive to international researchers by offering excellent career opportunities and working conditions.

Mobility plays an important part in career development. Whenever mobility is appropriate to foster their careers, researchers at all career stages, from all fields, and working in all sectors, should be allowed to be mobile; therefore, barriers to their mobility must be addressed. Furthermore, where mobility occurs it could become a stronger criterion in the appraisal of researchers, thus recognising its added value.

Science Europe Member Organisations, as funders and employers of a significant number of researchers in Europe, see it as their responsibility to lead by example and to work towards appropriate strategies to ensure the attractiveness of research careers, including by the provision of appropriate support instruments.

Science Europe Member Organisations wish to achieve a collective understanding of the factors determining the quality of research careers, by gathering evidence on issues such as career support measures, career development, support to interdisciplinary careers, mobility, and the consequences of 'brain circulation'.

For issues outside of their direct remit, Science Europe Member Organisations can bring evidence-based advice to policy makers, stakeholders and institutions, thereby contributing to improving European- and

national-level policies and programmes for different career stages and paths.

In particular, Science Europe can inform policy in the following areas:

- True portability of pension funds and other social security benefits for researchers;
- A European Researcher Development Framework which can aid the professional development of researchers; and
- Achieving an appropriate balance of, and level of complementarity between, activities funded at national and European level. This is important to avoid duplication and inefficiencies in the long term, whilst maintaining a healthy level of competition between systems.

Science Europe's Objectives

The principal aim of Science Europe in this area is to adopt a common strategy to ensure the attractiveness of research careers. This is intended to create and improve European-level, and co-ordinated national-level, policies and programmes for different career stages and career paths.

This strategy will require:

- Collecting, sharing and analysing evidence on the needs for career support and the effectiveness of existing career measures;
- Promoting the tracking and monitoring of researchers' careers;
- Assessing the need to improve existing career support instruments, with a particular focus on the post-doctoral career stages;
- Assessing the need to adapt the criteria and indicators used to appraise researchers' achievements;
- Improving the information available to researchers on their increasingly diverse career options, including at the early stages;
- Exploring the added value of mobility, including identifying both good practice and potential scope for improvement of tools and conditions to support geographic, inter-sectorial, interdisciplinary and virtual mobility; and
- Contributing evidence and advice to policy debate.

Research Infrastructures

Enhanced research infrastructure policies will contribute to:

- **Supporting borderless science** – by making it easier to access national infrastructures; and
- **Facilitating science** – by improving and aligning funding decisions throughout the life-cycles of research infrastructures, and by increasing operational efficiency.

What is the Issue?

Research infrastructures (RIs) are of strategic importance in the context of the European Research Area. Excellence in research requires excellent infrastructures, for data collection, management, processing, analysing and archiving; this is the case in all disciplines. Infrastructures are imperative for the advancement of science and for scientific communities; they lead scientific development in new directions, create an attractive research environment, and support international collaboration.

The majority of funding for the construction and operation of RIs is granted at national level. Co-ordinated development of future policies and funding schemes related to RIs is crucial. Research Funding and Performing Organisations, as funders, hosts, operators or users of RIs, play, and will continue to play, a significant role in this respect.

The importance and necessity of building or upgrading major RIs of pan-European relevance have been demonstrated, predominantly via the European Strategic Forum on Research Infrastructures (ESFRI). However, a large number of research infrastructures already exist in Europe. They differ in size and visibility in comparison with those on the ESFRI Roadmap, yet still require discussions on the necessary funding or boundary conditions for their operational phase. It is crucial that the European debate also takes these RIs into consideration.

Progress has already been achieved regarding key areas, such as: reaching a common understanding of what constitutes a modern RI; agreeing minimum quality standards for (external) access to RIs at the European level; investigating funding and evaluation of RIs, as well as indicators of European relevance; fostering networks of RIs; and initiating the mapping of RIs. However, simplified access to RIs and new RIs in less research-intensive countries still need special attention. Furthermore, progress towards innovative data-tools and data-infrastructures, to facilitate exploitation of the potential afforded by data-intensive research, is required.

Long-term sustainability in the field of RIs will necessitate harmonised management and networking practices leading to efficient access to RIs, improved funding of RIs throughout their life-cycle (construction, operations, management, upgrades, decommissioning) and implementation of proper metrics to assess the impact of RIs.

Science Europe's Objectives

Science Europe will strive to sustain a fruitful exchange with all appropriate European fora related to RIs – either Member States-led, such as ESFRI, or RI-led, such as the European association of national Research Facilities laboratories (ERF) and the partnership of Europe inter-governmental scientific research organisations responsible for infrastructures and laboratories (EIROForum) – and to promote the need for alignment between their respective strategies and activities.

Science Europe will take action to:

- Review Member Organisations' drivers and strategies for funding and evaluation of national RIs of European interest, and promote their alignment when and where appropriate;
- Advance the development of e-infrastructures;
- Advance the management and networking of RIs;
- Identify and tackle RI needs of the scientific communities that warrant joint discussion between Science Europe Member Organisations, and
- Produce consolidated positions for, and contribute to European and global fora related to, RIs, promoting the adoption of recommendations as appropriate.

Research Integrity

Enhanced research integrity policies will contribute to:

- **Supporting borderless science** – by fostering the harmonisation of procedures related to research integrity across disciplines, institutions and borders;
- **Facilitating science** – by increasing the efficiency of the R&D system through increased trust between scientists and in scientific results, and by reducing the likelihood that funding is misused;
- **Communicating science** – by helping to build and maintain public support for science, and by reducing the risk of misinformation based on misguided research; and
- **Improving the scientific environment** – by reducing the risk of unfair career advancements based on fraudulent results, by cultivating good research practices and embedding them in an improved research culture, and by strengthening the global normative framework around research integrity.

What is the Issue?

Research integrity is intrinsic to research activity and excellence. It is at the core of science itself, and is a basis for scientists' trust in each other and in the scientific record, and, equally importantly, society's trust in science. Addressing research integrity requires a holistic approach, given the linkages with other aspects of the research system, such as access to publications and data, research careers, evaluation, peer review, and research collaboration.

Individual or collective research misconduct can cover a broad spectrum of acts, but its most detrimental forms are fabrication or falsification of data, including under-reporting of data (which can have potential effects beyond the sphere of science itself) and plagiarism (which can distort the internal system of scientific evaluation). Beyond these, other, and perhaps even more frequent, cases of research misconduct include questionable research practices, the misuse of research data, authorship-related misconduct, and inadequate personal or leadership behaviour.

Whilst the ultimate responsibility for good research practice lies with the individual researcher, it will only flourish in an environment that embraces personal responsibility, and where there is an understanding that safeguarding research integrity is a shared task; this is especially the case in a highly-competitive research environment. Therefore, the research community as a whole, its institutions and its research funding providers share the responsibility for raising awareness of good research practice and promoting and supporting adherence to this, as well as dealing with infringements.

The Singapore Statement on Research Integrity issued in 2010 provided, for the first time, a foundational document on a global scale.

At a European level, the development and dissemination of the European Code of Conduct for Research Integrity of March 2011, issued by the European Science Foundation and All European Academies (ALLEA), was an important step in creating a normative body around the issue, addressing a wide range of actors involved in the research endeavour.

On a national scale, many institutions around Europe, including Research Performing and Research Funding Organisations, academies, universities and ministries, have put in place structures to promote research integrity and to deal with misconduct. In many European countries, legislation and policies have been developed to address issues of research integrity. However, the decisions of research integrity authorities are still not sufficiently legally robust and therefore remain vulnerable.

Science Europe's Objectives

Science Europe Member Organisations will strive to consolidate the emerging normative structure around research integrity, to move towards a harmonised implementation in Europe and to ease research collaboration, by:

- Promoting research integrity: this includes working with all relevant parties to articulate and promote the centrality of research integrity, most notably in the education and training of researchers.

- Increasing knowledge: Science Europe Member Organisations will seek to expand their common understanding of the types, frequency, causes and effects of research misconduct. Science Europe will facilitate regular exchange of best practice and experiences, and will strive to promote research on research integrity.

- Preventing misconduct: this includes developing appropriate incentives for fostering a culture of integrity, and setting high standards for researchers and institutions. All aspects of the research process – from funding, through employment contracts, peer-review processes and collaborative projects, to handling research data and publications – should take integrity issues into account. All sanctioning measures must be underpinned and preceded by pedagogical efforts aimed at instilling a culture of integrity, and at preventing the occurrence of cases of research misconduct.

- Dealing with misconduct: this includes working towards removing potential incompatibilities in procedural frameworks for research integrity between different disciplines, organisations and countries. Within their own remit and capacities, Science Europe Member Organisations will aim to identify and promote good practices related to the protection of 'whistle blowers', the fairness of procedure (including presumption of innocence), the proportionality of decisions and sanctions, and the possibilities for appeal.

Research Policy and Programme Evaluation

The improvement of research evaluation activities will contribute to:

- **Facilitating science** – by improving the evidence base at the disposal of policy makers, and by producing more effective policy strategies which will lead to higher-impact science policies and programmes; and
- **Communicating science** – by increasing transparency regarding the contributions of research and the research system to scientific, socio-economic, cultural and other progress, and by supporting Science Europe in communicating its policy message.

What is the Issue?

Ensuring the efficiency, quality and impact of research policy and programmes is an essential responsibility of organisations involved in the funding and performance of scientific research paid for from public funds. This requires timely and methodologically robust procedures for evaluation.

Analysis, *ex-post* evaluation and indicator-based assessment are important tools for empirically testing the success of policies, for strategy development, for developing an evidence-based European Research Area, for international comparison and benchmarking, for identifying conditions that are conducive to excellent science, and for assessing the contribution of research organisations to socio-economic progress. This relates to all potential objects of evaluation: research funding agencies, research institutes, funding policies, research fields or scientific disciplines, funding schemes, and research grants.

Science Europe Member Organisations are committed to the continued development of their evaluation activities, including the increase of knowledge through mutual learning.

Previous experience has demonstrated that there is a large diversity of methods and approaches to evaluation. Research evaluation is a rapidly-developing field in which good progress has been made in relation to trust and relationship building, exchanging information, analysing evaluation practices and developing methodologies for evaluation. The relevance, and also the complexity, of assessing scientific, organisational and societal impacts have been acknowledged and explored.

A diversity of approaches is needed to allow the analysis of the outcomes of policies and programmes in various national, organisational and disciplinary contexts. This diversity is also prompted by the need to address different evaluation questions, and represents an opportunity to test new indicators and methodologies. However, increasing the effectiveness of evaluation activities requires a shared understanding of the governance of such activities and of the uses of evaluation outputs.

Furthermore, indicators can play an important role in supporting robust and comprehensive analyses, by providing data capable of being re-used in different contexts, or of delivering some degree of comparability across organisations and over time. Currently, the diversity of approaches allows limited comparability and data re-use and therefore more collaboration is needed in this respect.

Better-aligned evaluation methodologies could be of benefit in assessing the other policy areas outlined in this Roadmap. This would contribute to the advancement of Science Europe Member Organisations' shared research policy objectives, in the context of the rapid development of new indicators by a variety of international policy players.

Science Europe's Objectives

Science Europe intends to contribute to advancing the development and implementation of standards for the definition, acquisition, storage, analysis and sharing of evaluation-related data.

Science Europe will:

- Promote and disseminate the results of previous work (including on evaluation design, choice of methods and indicators that allow identification of suitable funding conditions, and efficiency and impact enhancement in publicly-funded research);
- Develop a common understanding of the governance and decision-making of evaluation mechanisms, as well as on the use of their outputs;
- Promote, where appropriate, the alignment of evaluation activities and data-generating processes at national and European levels, in order to enable comparative studies and joint projects;
- Facilitate a shared understanding of indicators and evidence-based decision making by promoting participatory processes for indicator design;
- Closely follow European and international initiatives related to the evaluation of research policy, and develop an understanding of Member Organisations' own data gathering and aggregation capabilities for policy evaluation purposes; and
- Where relevant, make consolidated contributions to European and international policy debates about appropriate indicators, evaluation methodologies and processes.

Science in Society

Science in Society activities will contribute to:

- **Communicating science** – by increasing public awareness of the benefits of science, by providing channels to voice public concerns over scientific research, and by allowing science to better contribute to education;
- **Facilitating science** – by widening the talent pool at the disposal of the science system, and by improving research as a result of societal input; and
- **Supporting borderless science** – by helping to build stronger links with market players and other sectors of society, and by fostering the interdisciplinarity needed to tackle societal challenges.

What is the Issue?

Society and social processes are changed by scientific research and technological development; indeed, science and technology can act as powerful drivers of social evolution. Similarly, social structures, attitudes and processes can shape and influence science, and can impact on its role in society, its objectives and its practices. Science Europe Member Organisations, as public research organisations, play a central role within this complex system of two-way interaction and communication. Researchers and research institutions engaged in performing and supporting research have a contribution to make to societal debate, just as citizens need to be involved in discussions about science and research.

Researchers must be aware of, and responsible for, the potential consequences of the 'translation' of scientific knowledge in society. Translation means that scientific knowledge 'migrates' from its origin, to join with other types of knowledge in society, both in the public and private sectors. There is no single, simple, linear translation; rather, there are multiple modes of translation, which depend on different elements within society and within institutions devoted to social activities, such as education, economy, innovation, democratic decision-making and communication. The constant interaction of scientific knowledge with other cultural activities within society is an important process that enables societies to evolve, and creates new links between society and science. In this context, researchers share the responsibility for the translation and co-creation of scientific knowledge with other partners in society.

Science in Society (SiS) refers to any activity aimed at strengthening the relationship between publicly-funded science and society. This includes information and communication, events, services, advice, awards and prizes, funding instruments, public participation and engagement activities, guides, and training ('Science in Society: a Challenging Frontier for Science Policy' by the European Science Foundation Member Organisation Forum on Science in Society Relationships, June 2012)

Science Europe Member Organisations believe that SiS activities are essential to ensure that:

- Public concerns are voiced, and public awareness and recognition of science are increased. The endorsement by taxpayers of the purpose and priorities of publicly-funded research must be earned rather than expected. Public awareness of the contribution that research makes to society is important to strengthen trust in scientific research;

- The research process benefits from public participation, which can contribute significantly to identifying and framing problems, or pointing towards their solutions;

- Science contributes to competitiveness by giving input to, and receiving it from, market players;

- Scientific activities contribute to primary, secondary and higher education;

- Scientific careers attract talented individuals; and

- A balanced relationship between scientific and societal priorities is embedded in science policy. Science policy in turn needs to be inclusive and to foster new forms of co-operation with all societal partners. There must be respect for scientific autonomy, and a substantial contribution must be made by publicly-funded research to meeting societal challenges.

Much is already being done in SiS activities, but these activities must be developed further to meet the new challenges arising in Europe and the world.

Science Europe's Objectives

At a time when Europe is reflecting on its capacity to respond to societal challenges, Science Europe will encourage the development of science in society as a pillar for science policy.

Science Europe will:

- Promote a shared understanding of the objectives of SiS activities performed by Member Organisations;

- Share experience of practices, methods and evaluation related to SiS activities with the aim of fostering collaboration in, and comparison of, SiS activities in Member Organisations; and

- Promote the development of guidance based on previous recommendations in the area, so that Member Organisations can increase the quantity and quality of their SiS activities.

Science Europe is a non-profit organisation based in Brussels representing major Research Funding and Research Performing Organisations across Europe.

More information on its mission and activities is provided at: www.scienceeurope.org.

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SCIENCE EUROPE
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