



Inspiring
researchers,
strengthening
Europe

Vision and strategic goals

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Introduction

“The trick to having good ideas is not to sit around in glorious isolation and try to think big thoughts. The trick is to get more parts on the table.”

Steven Johnson,

‘Where Good Ideas Come’. The Natural History of Innovation.

For Europe’s future, its scientists and innovators are its most precious asset. Already, they are hugely productive: The source of nearly a third of the world’s ideas, as measured by scientific publications or patents. Their work helps change the world: the structure of DNA, the birth of mobile telephony, the science of climate change, the expansion of wind and solar energy – all are life-changing developments to which European scientists, engineers and entrepreneurs have made profound contributions. Now, as our social and economic challenges mount, our best hope for solutions will come from them.

From its origins in 1971, what is now the COST Association has been helping scientists find solutions. It helps them meet, network, exchange ideas, find partners. It empowers them to set their own destinies: To propose their own areas of networking and collaboration. It strengthens diversity, the intellectual fuel of the scientific enterprise, creating opportunities for researchers who may be in emerging disciplines, at an early stage in their careers, or in countries still building their scientific capacities. It helps Member States get greater impact for their research budgets, by cross-pollinating ideas and people. In a manner unique in the world, COST offers a free, open zone in science to harness the power of hybrid thinking, fresh perspectives, and wider understanding. This kind of freedom – COST freedom - will be essential if we as a society are to think our way out of our problems: of climate change, ageing populations, energy supply, social tensions, international conflict.

But the scientific enterprise itself is changing, and COST must adapt to stay relevant. Digital technologies are transforming the way scientists and innovators meet and collaborate. Budget cuts in many countries are forcing new methods of working and sharing. An extraordinary growth in cross-disciplinary and cross-border research impels people to find new partners. And as science, technology and policy intermingle – from GMOs to cyber-security – they pull more researchers into a policy sphere of evidence and advice they had never previously imagined.

This document proposes how COST will adjust its strategy for this challenging future. This offers a long-term perspective, approaching 2030, on our core goals. Based on this, an action plan can be developed to guide management over the next decade. Our ambition: To continue, now and in the future, to be the organisation that creates spaces where ideas and people can grow without limits.

01

COST today

COST -European Cooperation in Science and Technology- has been a building block of Europe's research world for nearly 50 years. It is an intergovernmental organisation, with 36 Member States spanning the European continent. It funds networks across borders and often across scientific disciplines, interlinking nationally funded researchers and innovators. It has long been, and remains, the largest framework for transnational coordination in science and technology across Europe. In all, nearly half a million researchers have participated in COST over the years.

It works mainly through what we call a COST Action. This is a network of researchers, technologists and other interested parties focused in a particular area, collaborating across borders. A COST Action funds conferences, workshops, short-term scientific missions, training schools, publications and other communications tools to link the participants together over four years. It must include participants from at least five Member States – but the average COST Action covers 22 countries. COST Action participants typically receive EUR130,000 a year for travel and meeting support. Actions are run by a committee representing the Member States involved.

As of 2016, there are more than 300 different COST Actions going on, involving about 45,000 researchers. The topics are hugely diverse and very targeted. For instance, there are Actions now to analyse proteins with mass spectrography, important to medical research; to track water vapour in the atmosphere with GPS satellites, for climate change; to develop strains of mice for research into ageing; to set up databases so public-policy researchers can compare local-government reforms; or to study how paroled criminal offenders are supervised in the community. Any imaginable research area – either established, such as history, biology, ecology, astronomy, criminal justice, or newly emerging such as systems biology, renewable energy, sustainable architecture or behavioural economics – can be covered in a COST Action. For instance, seagrass ecosystems are, along with rain forests, among the planet's most important, carbon sinks, yet they are poorly understood; a COST network is now combining underwater ecologists, experts in genomics, conservation managers and others. Another network, on "ageism", unites geriatric and other researchers with policy makers, community groups, NGOs and elderly people, in an effort to bring several perspectives to bear on a growing social problem.

What's special about COST Actions

- COST Actions are initiated "bottom up" by researchers themselves, allowing them to build networks in any area – especially those excluded from other programmes as risky or outside the mainstream.
- They are open to all fields in science and technology and to all partners from COST members and beyond.
- They are highly inter-disciplinary, permitting new insights and new approaches to problems that might otherwise be intractable.
- They connect both established and younger researchers, increasing visibility, fostering excellence, and facilitating access to broader programmes, such as Horizon 2020.
- Anybody can join a COST Action at any time during its four-year run; you don't have to be in the starting team to play.
- COST Actions can adapt as the science advances.

A noteworthy feature of COST Actions is the way they start. They are proposed 'bottom-up', by the researchers. Nobody in government, with a policy agenda, specifies them. There is a continuous, open call for proposals to set up Actions. The proposals are evaluated against the criteria of excellence and impact. An independent peer-review system ensures high quality evaluations. The competition is intense, so great is the appeal; about 10% of proposals win.

Also special is who gets involved. COST Actions often engage young researchers and others groups striving for success and inclusion in the senior councils of science; indeed, about 30% of Action participants are young researchers. COST makes a special effort to promote gender balance in science. COST Actions aren't closed or static; they are open at any time to anyone who applies and is qualified to join – from industry, society, policy and other domains beyond the immediate scientific discipline. And while the Member States form the core, COST also fosters cooperation with researchers in countries neighbouring Europe and beyond. It is open in every sense of the word.

COST has accumulated extensive experience over the years in programme administration and network management. When what is now COST began in 1971, it had 19 members. Today, its 36 members stretch from

Iceland to Turkey (plus Israel as a cooperating state.) In 2013, it reorganised to become an independent legal entity. Today, the COST Association is an international not-for-profit association under Belgian law entrusted to run the framework, including administration, programme steering and funding management.

The core funding for this comes from the European Union; within the Horizon 2020 research and innovation programme, about EUR300 million has been set aside from 2014-2020 to support COST and its Actions. But the research itself is funded by COST Member States. This makes every COST Action a coalition of willing participants – a genuine tool for bringing interested parties together who want to advance a domain of science, cross disciplinary boundaries, fulfill their professional goals, and promote international collaboration.

Who gains from COST?

The benefits of COST are broad. It provides opportunities for researchers at any stage of their careers. Established scientists can use COST to collaborate with high-level institutions and connect with peers. They get opportunities to share research infrastructure, develop new skills or knowledge, and link their students and post-doctoral researchers into

The COST impact

- 95% of COST participants say their careers developed and their prospects improved due to their involvement.
- During the 7th EU Framework Programme, COST Actions allowed the interconnection of EUR5 billion in national research and technology projects with a COST investment, as the 'glue' between them, of just EUR250 million.
- Competition for COST Actions is intense, highlighting demand and excellence: The success rate is 10%.
- COST Actions contribute to diversity in science: About 30% of participants are young researchers. Half the Actions include industry, large or small. All include researchers from at least five countries – and the average is 22.
- COST Actions have high impact in their fields. One Action, on photosynthesis, led to a new class of biosensors to monitor the environment and check food quality – and then, unexpectedly, suggested a new kind of light-harvesting cell for energy production. Another Action, on food safety and distribution, led to 29 research projects with EUR10 million in funding, a significant advance in nanotechnology-based food packaging technologies, and involved 13 companies alongside the researchers. Another Action, on honey-bee colony loss, produced a key international manual for studying this problem, and led to the creation of an international association for action. Yet another Action led to new statistical techniques adopted by the Swiss meteorological office in its national climate change strategy, and in flood monitoring on the Rhine and Aare rivers.

international networks. Younger researchers who apply independently for a COST Action get an equal shot at success with more-established researchers – propelling their careers and broadening their networks. Special effort goes to ensure diversity of gender and origin, empowering those who might otherwise be shut out of established networks.

COST goes beyond science alone. About half of the current COST Actions have participants that are from large or small enterprises – meaning they strengthen open innovation networks across Europe. They increase the odds of research results being taken up by industry, and turned to economic value. For instance, one COST Action, MI-NET, brings mathematicians and industry together from 30 countries to discuss new applications of mathematics in business: in metal moulding, in delivery of healthcare services, in modeling for air pollution, weather or nuclear safety. In COST actions, open science and open innovation are realities. Knowledge across disciplinary and sectoral boundaries is shared.

For national governments this means that their investment in research is better used. In each field, COST builds a critical mass of researchers with relevant competences to bring research forward, and raise the odds of breakthroughs; in this regard, COST Actions are often a test-bed for new ideas. They also reduce fragmentation, from one country or discipline to another, across Europe. Redundancy is cut. Quality and ambition are raised. National research institutions build networks and find new funding sources. COST Actions can build bridges between new and old EU

Member States, as well as other COST Member States, linking their institutes, universities, companies and other organisations. This is a material contribution to the European Research Area, the EU effort to make a single market for ideas, researchers and innovations.

For the European Commission, COST Actions often evolve into collaborative networks for Horizon 2020 – making them staging zones for high-impact research and innovation. In some cases, COST participants have contributed to new regulatory frameworks at national and European levels. By exploring new and emerging fields, COST Actions are tools for foresight, in science and policy.

For society at large, COST Actions perform a vital task of helping organise research that will solve major problems. Progress in science and technology requires collaboration, in as open a manner as possible. The first step in any collaboration is quite basic: getting the right people together. COST Actions address the obvious Grand Challenges, of ageing, climate, energy and the rest. But they also tackle prosaic problems, like preventing head injury in a bicycle or motorcycle crash. One COST Action, now completed, shared expertise on the design of cycle helmets.

As one COST participant puts it: A COST network is “probably the most effective tool to foster new EU-wide collaborations, and to get under one umbrella the involvement of all relevant stakeholders in a specific research topic.” Another put it more colourfully, calling COST a “delivery room” for research with long-range value to Europe.

02

The challenges ahead

Since its founding, COST has seen and contributed to profound changes in science and technology. But also during this period, the very nature of science has changed, becoming more global, collaborative, data-intensive, and challenge-oriented. Now, the research community faces a new set of challenges – to which COST must respond.

01

Digital technologies are transforming the way scientists and innovators meet and collaborate

Thanks to the Internet, research travels further than ever before. The Web provides a shop window for talent. Through high-profile TED Talks, the annual “Falling Walls” conference in Berlin, massive online courses and other means, researchers can share their work with millions around the globe. Scientific papers, previously stowed behind publishing paywalls, are instantly accessible: in the first decade of this century alone the number of open-access scientific journals climbed seven-fold to nearly 7,000, and by 2014 about 22% of newly published research papers were available free for all on the Web. Instead of waiting months to publish in journals, many scientists are going ahead and sharing their work online in an instant. This pressure for openness means the old “business model” for new research is changing. The scientists behind the successful Human Genome Project made the data public. In doing so, they outflanked others’ attempts to patent the human genome.

But perhaps the biggest change is in the myriad collaborative opportunities that digital technologies allow. Giant social research networks, where researchers can virtually exchange business cards and ideas, have taken off in a big way. Berlin’s ResearchGate is used by eight million researchers, San-Francisco-based Academia.edu has over 27 million members and London-based Mendeley claims four million. For science today, networking is no longer an activity done solely at conferences or training workshops; it is a virtual, as much as real-world, enterprise.

These inter-related trends are what is behind the current movement towards open science. It began simply: A push by several science funders to open access to scientific papers that the public had already paid for through research grants. But it has grown into an entire new philosophy of science: Sharing research data, mining text for new insights, collaborating in international online networks, transparent peer review

of research grants and papers. It makes it possible to check results, increase reliability, re-use information and resources – and, often, come up with new insights that otherwise would not have been imaginable. In Brussels, Carlos Moedas, EU Commissioner for Research, Innovation and Science, has set out his key policy framework as three “O”s: open science, open innovation and openness to world collaboration.

Any organisation, like COST, that networks people must embrace these digital technologies. Even better: Its networks can pioneer new applications – in open science, in virtual networking, in text and data mining, in online education. It can create knowledge hubs – a Wikipedia-like online repository of data and analysis on key scientific questions. COST can be a digital test-bed for science.

02

Tight budgets in many countries are forcing greater efficiencies and pooling of resources

While research spending is rising globally, the budgetary pressures within individual countries are heavy – especially since the 2008 economic crisis. This creates a pressure to rationalise resources, to use them more efficiently, to avoid duplication and fragmentation of effort. And all of that requires more pooling and sharing.

As a result, expensive lab equipment, research infrastructure, skilled labour and intellectual property are getting shared more often. New partnerships arise. In recessionary Finland last year, for instance, universities were forced to develop new sharing arrangements. Especially appealing is sharing costs internationally. Later this year, 11 nations will jointly commission an X-ray laser facility, European XFEL, to probe viruses and molecules at sub-nanoscale; the EUR1.22 billion cost could only have been undertaken as a pooled resource. Within the EU, Horizon 2020 received a record 90,641 applications in its first two years. In 2014 China and the UK agreed to spend GBP50 million to step up their joint research collaborations, in fields such as climate change and renewable energy.

A form of policy sharing has also taken hold in Europe. Since 2008 the European Commission, EU Member States and other countries participating in Framework Programmes have been trying to coordinate better some of their national research strategies. These Joint Programming Initiatives, now operating in scientific

fields addressing 10 societal challenges, pull together ministries, funders, research institutions and others. Though voluntary and without a formal legal identity, they try to develop a common research agenda and launch some joint calls for research proposals. But in fact, this process has sometimes proven difficult to manage.

COST can help: Its experience in managing diverse research networks can provide a new model for coordination, backing up and complementing the JPIs. And more generally, its low-cost, high-quality networks create a cost-effective way to achieve, not just better value for money, but also opportunities for the best to excel. And in the end, whatever the budgetary pressures that research institutions may face, the overall goal is great science and high-impact innovation. That is a challenge COST can help Europe meet.

03 Growth in cross-disciplinary and cross-border research impels people to open their networks

In science, borders are out; crossing boundaries, of discipline or country, is in. This brings diverse streams of scientific reasoning to bear on a problem: Urban traffic management, for instance, can be transformed when mathematicians look at flow models, economists study congestion charging, transport and electrical engineers re-invent the car, sociologists look at the way people decide their travel routes. All of them brought together, comparing notes across borders, can transform what it's like to live in a city. It makes the science better. And it anchors the outcomes in society.

The cross-border aspect of collaboration is particularly well documented. Already by 2009, about half of all published articles by German, French and British scientists had co-authors from other countries. Globally, the average was about one in five articles internationally co-authored. Their quality and impact were higher. Individual scientists can bear testimony to the potential of open, networked science. In 2011, Cambridge University Prof. Timothy Gowers posted a few tricky mathematics problems on his blog; he later co-authored several papers with the people who read and helped crack them.

This kind of serendipitous science – a product of open, cross-border and cross-disciplinary collaboration – is also what we will need to bring science closer to the citizen. First, in some fields it permits direct involvement: Astronomy would be severely hobbled if it hadn't invented a way for amateurs to join in the quest for knowledge, with their home telescopes and computers. Second, it permits a better solution to our global challenges; the International Panel on Climate Change already benefits, in its periodic reports, from international feedback from other researchers and citizens, wherever they are.

Of course, all this mobility can pose challenges, too: Brain drain can be a special problem for countries still building their scientific capabilities. As with the other challenges listed so far, so with this COST can find new opportunities for growth, relevance and value to Europe. COST's international networking can provide a way for researchers to stay connected – and stay home, rather than feel they have to move abroad to advance their careers. Its Actions are the very model of openness: Anybody can propose, anybody can join. The only constraints are to involve multiple countries, focus on scientific excellence, and deliver high impact.

04 The relation between science and society is changing

A few centuries ago, science was in and of itself: a career or passion for a relatively small educated elite in London, Paris, Berlin and a few other capitals. It is now deeply enmeshed in society, the economy, politics – the lives of every individual on the planet. Its leading figures are often celebrities. Its findings drive political debate over GMOs, climate change, the economics of wealth and inequality, human embryonic stem cells and more. This poses many challenges for science, and for COST.

First, within our 21st century society, there is often a confusion between the science we might want – profound discoveries and Nobel Prizes – and the science we think we need: relevant here and now to specific problems. We might like to understand gene expression inside the brain, but really we want a “cure” for Alzheimer's. Of course, both are necessary. But it is increasingly difficult to apportion budgets for science driven by curiosity, and science driven by challenges. The 2015 Lund Declaration, published by the Swedish Research Council after pan-European consultations, tries to balance these goals. But in the end, what's needed is for scientists to engage more effectively with the rest of society. How? How to communicate science better to the broader public – particularly when, increasingly, individual citizens are looking to science for specific answers about their own lives: what to eat, how to stay healthy, how to keep safe? COST, with its broad networks of researchers, engineers, business people, policy makers and NGOs can be part of the answer: an outreach mechanism for science to society.

Second, within government, policy makers are increasingly asking scientists to advise them on complicated issues – or rather, to provide solid evidence that can inform better policies. As a result, governments around the world are experimenting with different ways to get good scientific advice into their policy decisions. Science advisors, forums and high-level councils are sprouting up everywhere, from Australia and Cuba to Czech Republic, India, Malaysia and New Zealand. In August 2013 experts from more than forty-five countries assemble in Auckland, New

Zealand, for the largest-ever summit on scientific advice; another is planned in Brussels this year. In 2015, the European Commission created a new, seven-member Scientific Advice Mechanism to make the manner in which it gathers policy evidence transparent, predictable and credible. Here again, COST can play a role: Its networks can provide the information-sharing necessary to good scientific advice.

Lastly, there is the challenge of shaping society, itself. Technology has changed the way we live: mobility,

privacy, longevity, income distribution – virtually every aspect of society has been transformed in just the past generation. Yet, even as our technology advances, we are still unable to understand basic human behavior, or organize a peaceful society. These are matters for the social sciences and humanities, but also for collaborative research across all disciplines – from physics to psychology. Because of their cross-disciplinary nature, COST Actions can help gather the minds needed to improve society.

These are just a few of the challenges facing the world of research in Europe – and all create opportunities, and risks, for COST. In what follows, we suggest four strategic goals that will help COST grow through these challenging times, and contribute to the well-being of Europe and science.

03

Strategic goals

COST is unique. It provides a framework for researchers of every type and origin to meet, collaborate and advance science together – in the way they think best. It reaches beyond science, to industry, policy and society at large. It is flexible, changing and dynamic. It is open-minded, pays attention to scientific uncertainties, and invites unforeseen ideas and solutions. It provides freedom to explore any option or idea.

These attributes mean COST has a special ability to meet the challenges just described. These are not short-

term problems or opportunities: they will continue to shape the world of science for years to come. As such, COST needs a long-term vision. How should it respond? Here, we suggest four priorities on which COST should focus its work as we move towards 2030 – four ways that it can inspire Europe's researchers to advance science and society, and that it can help make European science stronger. These broad goals, once set, can be implemented in the years to come.

GOAL 01 > ENHANCE COLLABORATIVE, BOTTOM-UP RESEARCH

Breakthroughs in science or technology can't be ordered up. They just happen, with the right people, support, framework and luck. The HTTP protocol, the seminal feature of the Web, arose from a British programmer in Geneva playing with some new ways for physicists to collaborate on-line. The CRISPR gene-editing technology, now stirring international excitement, was discovered by a few German and American researchers wanting to understand how bacteria fight off viruses. In these and many other cases, what drives the researchers isn't always clear: sometimes curiosity, sometimes a challenge, often both. But always, the real breakthroughs come from the researchers themselves – 'bottom-up,' to use the currently fashionable science-policy terminology for it. And they almost always arise from smart people working together – collaborating in an open environment.

These two characteristics of good science – bottom-up and collaborative – are increasingly popular policy goals across Europe. The 2015 Lund Declaration mentioned earlier called for a renewed emphasis on challenge-oriented research; but it sees collaboration and research freedom as vital ingredients towards that goal. The European Research Council, the EU's frontier-science agency, is often praised for its pure, bottom-up methodology: open funding calls to which researchers propose whatever inspires them. Commissioner Moedas says he wants to apply the ERC's bottom-up principles to the Commission's collaborative innovation actions, as well.

In a current review of the Joint Programming Initiatives mentioned earlier, all sides in the debate support the fundamental importance of allowing researchers the

freedom to follow their passions as well as collaborate.

Another important dimension of research today is openness.

The 'Amsterdam Call for Action on Open Science' developed under the Dutch presidency of the EU in April 2016 demonstrates the commitment amongst Member States to achieve real open science by 2020 – including open access to scientific papers, text and data mining, re-use of data and much more. The digitalisation of science, real-time sharing of data and research infrastructure, new 'business models' for funding research, as well as networking and collaboration beyond the traditional boundaries of research institutions – all these will surely challenge the status quo in science. Openness means more competition. We can expect the emergence of new hybrid modes of how knowledge is produced and disseminated and commercialised. And this will have budgetary implications, putting more efficiency and effectiveness into the system. In short, the scientific enterprise is about to be disrupted – for the better, if openness can be well managed.

Openness, collaboration, bottom-up initiatives: Making all this happen is difficult. There needs to be an ecosystem – of institutions, programmes, policies and people – to support it. There needs to be a tool for sharing knowledge, for standardising and using digital research platforms, and for open access to scientific information.

COST is that tool. The starting point is the COST Action: a flexible, easy to use, easy to join system for networking. It provides a free space for researchers,

scientists, engineers and innovators to connect, meet, satisfy their curiosity and start working together towards some common, important goals for society or the economy. Breakthroughs require open, free thinking. They require a strong science base that makes blue-sky research possible and trial – and error – acceptable.

COST is, quite simply, unique in the European funding landscape. The kind of open, free exchanges of a COST Action – some researchers from disparate backgrounds and countries brainstorming informally together, on what they believe to be important – are vital assets for Europe.

To meet the challenges ahead, the COST Action should evolve in several ways:

> **Reinforce support for breakthrough ideas.** A COST Action lasts four years. That is too short for many scientific domains still in their infancy, or might be too long for other, very targeted work. COST should explore ways to tailor the length of an Action to suit the topic.

> **Create more occasions for inter-disciplinary networking.** COST should look across its Actions for overlapping thematic areas, and seek opportunities to interconnect them or explore the boundaries between them. Where there is potential for innovation, new policy directions or significant added value for science, COST should emphasise research outcomes in these boundary areas.

> **Use COST Actions to help identify and test new scientist-suggested topics for inclusion in EU and national research programmes.** COST Actions can, for instance, lead to new Calls for Proposals in Horizon 2020 – generated by the scientific community itself.

> **Introduce open science and open innovation approaches in COST Actions:** COST should investigate how open science and open innovation approaches can be integrated into COST Actions. This could be through enhancing virtual networking; encouraging the use of open science methods for developing a research field; sharing research infrastructure and data. It can also facilitate collaborative, citizen-driven gathering of evidence in many fields, such as the social sciences.

GOAL 02 > **BUILD ON COST'S OPEN, INCLUSIVE CULTURE TO EMPOWER RESEARCHERS ALL OVER EUROPE**

COST's network is big and diverse. Since its founding, it has helped nearly half a million participants – from every possible background, country and discipline. Its record in gender balance is excellent. It makes a special effort to attract young researchers just starting their careers, rather than established professionals only. About half of COST Actions include industry participants, rather than scientists alone. Twenty of its 36 member-countries are in its "inclusiveness" targets – countries, with still-developing scientific capabilities, that would help themselves and the rest of Europe by interlinking more closely with their neighbours.

Openness is key to the COST culture. Through COST, participants communicate effectively across national cultures, across borders of science and business, across established and emerging fields of academic research. Its open proposal process, with winners judged by the quality of their ideas rather than their political or institutional backing, puts everybody on the same footing, regardless of nationality or wealth. This is an important point: for COST member-countries, the way one evaluates research and innovation proposals is a top priority. A smart evaluation process is transparent and based on evidence. It assesses the potential impact of research more flexibly and comprehensively. It promotes excellence and relevance, and helps evaluate citizen-science initiatives more carefully. COST's evaluation process achieves all

of those goals.

This empowers people. It helps young scientists grow in their careers. It helps established researchers expand their horizons. It creates opportunities for researchers and innovators in still-developing countries to get partners, money and know-how they can't find at home. Indeed, by making it easier for them to network and collaborate internationally, it actually reduces the career pressure on them to leave their countries for work abroad; it helps diminish brain drain. And all of these factors together permit researchers, wherever they are, to attain an excellence that couldn't reach by working alone or in their old institutional silos.

Now, COST should build on this strength: use its open culture to empower even more researchers, to provide the space for them to do better science and the best possible uses. Specifically, it should:

> **Redouble its efforts to include people from COST Member States that are still developing their science and technology capabilities** – and making them leaders and prominent figures in future COST Actions.

> **Expand on initiatives to advance the careers of young researchers, and to promote gender diversity** – for instance, through the genderSTE network that COST created in 2012 to share experience in gender equality programmes across 40 countries.

- **Provide more and better tools**, for researchers in COST Actions, for digital networking, and data mining, so cross-border and multidisciplinary exchanges become easier.
- **Strengthen the widening potential of COST**. A vital goal of EU R&I policy is to “widen” programme participation beyond the older, more developed Member States. COST, with its inclusiveness strategy, can be a bridge between old and new Member States.

GOAL 03 > **BECOME THE LEADING OPEN NETWORKING TOOL IN THE ERA**

Europe without borders: despite mounting social tensions, this remains a core value of the European Union. And in the realm of science and technology, this translates into a set of policy goals called the European Research Area. Its vision: to create the world’s leading community for the free

circulation of researchers and ideas, to advance knowledge and innovation. The means are varied: a common policy for intellectual property, for open access to scientific knowledge, for mobility of researchers and engineers across borders, for stronger educational institutions and laboratories across the EU, for effective and compatible science and innovation policies from one nation to another. ERA is the research world’s contribution to the European Project.

COST has long been part of the glue in European science. Its networking binds together researchers across Europe. It knits together industry and academia, entrepreneurs and researchers. It often mixes disciplines together – biologists with data scientists, astronomers with economists – in unexpected but powerful ways. This kind of heterogeneity is the essence of open science and open innovation.

But it goes further. When we analyse COST Actions, we see they display many characteristics vital to the ERA. They foster excellence and openness to all scientific fields. They promote early-stage careers, inclusiveness, widening and large-scale networks.

This translates into concrete help to many specific programmes within the ERA. COST Actions, for instance, easily complement ERA-NETs, cross-border calls for research connecting and coordinating member-state research in targeted fields (often the result of a Joint Programming Initiative.) They can draw more participants to the knowledge communities of the European Institute of Innovation and Technology, or the extended networks of Joint Technology Initiatives. By making it easier to share best practice and strategies, COST can help Member States make better use of Structural Funds for regional development. COST Actions often lead to further collaboration in more-formal, Horizon 2020 collaborative projects: A COST Action is a platform for researchers to learn about the programme, and what it takes to build a Horizon 2020 consortium. About 30% of COST Action participants are young researchers, so COST can kick-start their entrance

into established research networks in Europe. This is helpful to the Marie Skłodowska Curie programme, the European Research Council, Future Emerging Technologies and other parts of Horizon 2020 that seek out the rising, young stars of science.

COST can also help Member States plan and execute their Joint Programming Initiatives. It has been working, for nearly 50 years, to network Member States without influencing their national research priorities. COST could act, on an intergovernmental basis, to facilitate the Cooperation and Support Actions that, increasingly, underpin the definition and creation of JPIs. With more, better and timely information on emerging scientific trends that cut across borders, member states are more likely to see the need for collaboration.

COST Actions spread knowledge of IP, open access and other ERA policies. It is a vital component of the EU’s science diplomacy: its networks can reach across the globe, inviting participants in countries both near to and far from its European base. And by attracting entrepreneurs, investors and other private-sector participants to its scientific networking, it can improve the whole process of innovation in the EU. It builds connections between companies and universities. It promotes open innovation strategies. And it stimulates entrepreneurship.

COST can build on these strengths, for the benefit of Europe. It can take its networking beyond face-to-face meetings, and add a digital dimension so participants – and alumni – can interconnect more easily and continuously. It can create meta-networks (“network of networks”) linking other research and innovation programmes. As mentioned earlier, we believe it can play a new and vital role in making Joint Programming a success. Some specific tasks would help make these broad ideas concrete:

- > **Analyse in detail how COST will contribute to each ERA initiative**. We urge a systematic review of each ERA activity –ERC, EIT, Eureka, JPI, JTI or others - and how COST can further strengthen it. Then, COST should approach the administrators of each activity to implement joint measures.
- > **Strengthen end-user participation** in COST actions and other initiatives driven by member states, such as Joint Programming Initiatives. This can be done by connecting COST Actions to member-state initiatives

physically – through joint conferences or meetings – but also virtually with open-science tools.

> **Enhance international cooperation.** COST is driven by and for its member-countries, which span EU Member States, neighbouring nations, and countries across the

world. COST should strengthen its ties to the Strategic Forum for International Science and Technology Cooperation, an advisory group to the European Council and Commission. And it can further contribute to the Commission's science diplomacy.

GOAL 04 > PROVIDE EVIDENCE-BASED INFORMATION TO SOCIETY AND POLICY STAKEHOLDERS ON EMERGING SCIENTIFIC AND SOCIETAL CHALLENGES

In today's information society, scientific knowledge is more than an end in itself; it's also a vital tool for policy makers, concerned citizens and society overall. Technology makes the world more complex: GMOs, cyber-security, urban planning, climate change – all are issues to which science speaks. Policy makers want the facts. They want early warning of troubles ahead, evidence for proposed solutions, scanning for emerging trends.

COST, with its Actions, can position itself as the European programme that best supports the unforeseen, the unexpected and the untapped potential of science across the continent. It can, with its networks, help spot the early signals of emerging societal challenges, and help develop innovative solutions for them. It can bring researchers, engineers, policy makers, social innovators and others together, from beginning to end of the task – or let people enter and leave the process wherever it seems best, in a non-linear innovation model. It can thus be a test-bed for new ideas. It can lead to more-formal, collaborative projects in national or EU funding programmes. COST Actions easily become innovation actions.

COST has a rare opportunity to aid its member countries in this task. Its Actions fund the networking that can stimulate new think tanks and policy research groups. COST can, by building a critical mass of experts from varied countries and disciplines, help spot emerging trends, technologies and societal challenges. Through its Actions, it has a vast trove of data to mine: reports, meeting minutes, participant lists, presentations, papers. This can help map scientific domains in Europe, so policy makers can gauge the depth, quality, and direction of knowledge in hundreds of fields. COST can have a pathfinder character for policy makers in all fields – energy, health, transport, agriculture etc. – who are anxious to anticipate opportunities and problems. It can, with this data, also help steer science and innovation policy itself. Its networks can spotlight emerging disciplines that need government support, or stimulate timely ethical debate about them.

At the same time, there is a broad social agenda that COST can support, as the role of science rises in

society. Through its networks, COST can help spread best practice in responsible research and

innovation – science performed in ways that support sustainability, ethical behaviour in the lab, and social responsibility. It can advance educational policies that further research and innovation – for instance, entrepreneurship training. In short, COST can help bridge the too-wide gap between science and society, evidence and policy, knowledge and citizen.

> **Establish cooperation with scientific advice bodies** in the member states and at the European level. COST can provide useful support to the growing network of these organisations – the Scientific Advice Mechanism, chief scientific advisors or learned societies that provide member-state advice.

> **Involve more citizens and policy stakeholders.** The use of digital networking methods (open science methods) will be encouraged in COST action with the aim to involve more citizens, policy stakeholders and end-users in the whole innovation cycle (from creation to application. It can explore crowd-sourcing of ideas, or even crowd-funding. It can, in short, help inform and engage individual citizens in the scientific method, thereby contributing more broadly to our 21st century knowledge society.

> **Enhance the use of “Targeted Networks” for foresight.** A new approach since 2012 has been the creation of Targeted Networks to strengthen the role of COST in a given policy area, stimulate the development of future-oriented societal challenges, and contribute to the European Union's longterm Europe 2020 policy goals. Four are operating now: gender in science, transnational programme management, young-scientist career development, and forest management and policy in the West Balkans. We believe that in this type of network, foresight exercises can be started and their results immediately tested within the diverse set of COST Action participants.

> **Develop a stronger science policy interface.** As mentioned, COST's deep and broad networks can provide unequalled insight into emerging trends and

problems in research policy; that kind of intelligence is valuable to Europe, and could be systematically tapped by policy makers across the continent. COST

will seek to enhance its links and decision support services for policy makers, on regional, national and European level.

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COST: the vision

COST has evolved over the years. At the start, it was the pioneer of European research collaboration, an exciting new tool to knit a growing Europe together. As it matured, it became a well-proven and efficient instrument of research collaboration, in a growing and variegated network of new programmes and ideas. Now, it has established a unique place in the ERA landscape.

Our vision for the next decade is optimistic. As our social, economic and environmental challenges mount, science is our best hope for answers. European science, in particular, has long been a core part of mankind's scientific capability. To continue that position, Europe must get even better at sharing knowledge, networking its researchers, increasing diversity, pooling resources for action. Already, through COST, the Framework Programmes, Eureka and other instruments, Europe has already proven itself good at collaborative research. By 2030 our vision is for Europe as pre-eminent in these new ways of cross-border, cross-disciplinary research – and as such, a force for science across the globe to work better and smarter with and for society.

But the vision goes beyond this. Science is people. Always, the real breakthroughs come down to individuals and their freedom to think, work, collaborate and share. At COST, we want to see a world in which a

brilliant chemistry post-doc in Prague can easily find and work with an established biologist at Heidelberg, a computer scientist in Ankara and a network of other peers across the globe – all with a few mouse-clicks, follow-up conferences and, subsequently, funded collaborative projects in their respective states. We want the researchers themselves to tell us what's important, what's cutting-edge, what needs action now. We want to see an unlimited space where crossovers between ideas and people can change the world for the better.

COST's mission is clear: Make that vision a reality. We have laid out the four prime goals needed to achieve that vision. We have suggested some specific steps that, in the course of 2016, we can elaborate into an action plan. Now, it is time to get working.

COST already empowers researchers, from every background, discipline and country in Europe. It maintains its core values of openness, bottom-up direction, diversity and collaboration. As we move towards 2020, the COST Association will embrace change. It will build on its internal strengths, extended networks, and nearly 50 years of experience. It will, through new means and strategies, continue creating spaces for people to connect, to share knowledge, to organise research and to grow without limits.

CHALLENGES to science, society and COST	GOALS for COST's strategic agenda
Digital technologies are transforming the way scientists and innovators meet and collaborate. More science and networking happens online – fueling the push for open science everywhere.	Enhance collaborative, bottom-up research. The openness and freedom of COST Actions make them ideal tools to pioneer new digital methods of networking and collaborating.
Tight budgets in many countries are forcing greater efficiencies and pooling of resources . This starts with researchers and institutions, but now extends to growing forms of collaboration between member-state science agendas and policies.	Become the leading open networking tool in ERA. COST can forge a place for itself as an indispensable tool to build the ERA, network old and new Member States, and pioneer new ways of networking.
Growth in cross-disciplinary and cross-border research impels people to open their networks. This creates opportunities for young researchers, women, and newer EU Member States to grow, and contribute more effectively to the international project of science.	Build on COST's open, inclusive culture to empower researchers all over Europe, pioneering new tools for networking more effectively.
The relation between science and society is changing. The balance between frontier and applied research is difficult to achieve, and policy makers expect scientists to provide clear evidence to unclear policy problems.	Provide evidence-based information to member states on emerging scientific and societal challenges. COST Actions can assemble expertise for difficult policy problems, and concretely help Europe coordinate better its national research agendas through Joint Programming Initiatives and other means.



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