

OECD STI OUTLOOK 2021

TIMES OF CRISIS AND OPPORTUNITY

OECD Science, Technology and Innovation Outlook
2021 - Insights for EU policy debates
Brussels, 12 February 2021

Key messages

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OECD STI Outlook 2021



- An OECD flagship publication
- Published every 2 years, since the mid-1990s
- Asks: “What’s new in the field of science, technology and innovation policy?”
- 2021 edition focuses on COVID-19
- Provides an international review based on latest policy information and indicators
- Based on work of the Committee for Scientific and Technology Policy (CSTP) and its working parties – the EC and most EU Member States are members
- Draws upon OECD STI statistical and qualitative data infrastructures





OECD STI Outlook 2021 – the narrative



Unprecedented mobilisation. Public research funders, private foundations and charities have set up an array of newly funded research initiatives worth billions of dollars in record time



Science and technology offer the only exit strategy from COVID-19. The pandemic has underscored more than in other recent crises the importance of science and innovation to being both prepared and reactive to upcoming crises



The pandemic has stretched research and innovation systems to their limits and exposed gaps and weak spots. There is an opportunity to reorient STI policies and direct science and innovation towards sustainable and inclusive futures





The STI system response to Covid-19 has been decisive, rapid and significant



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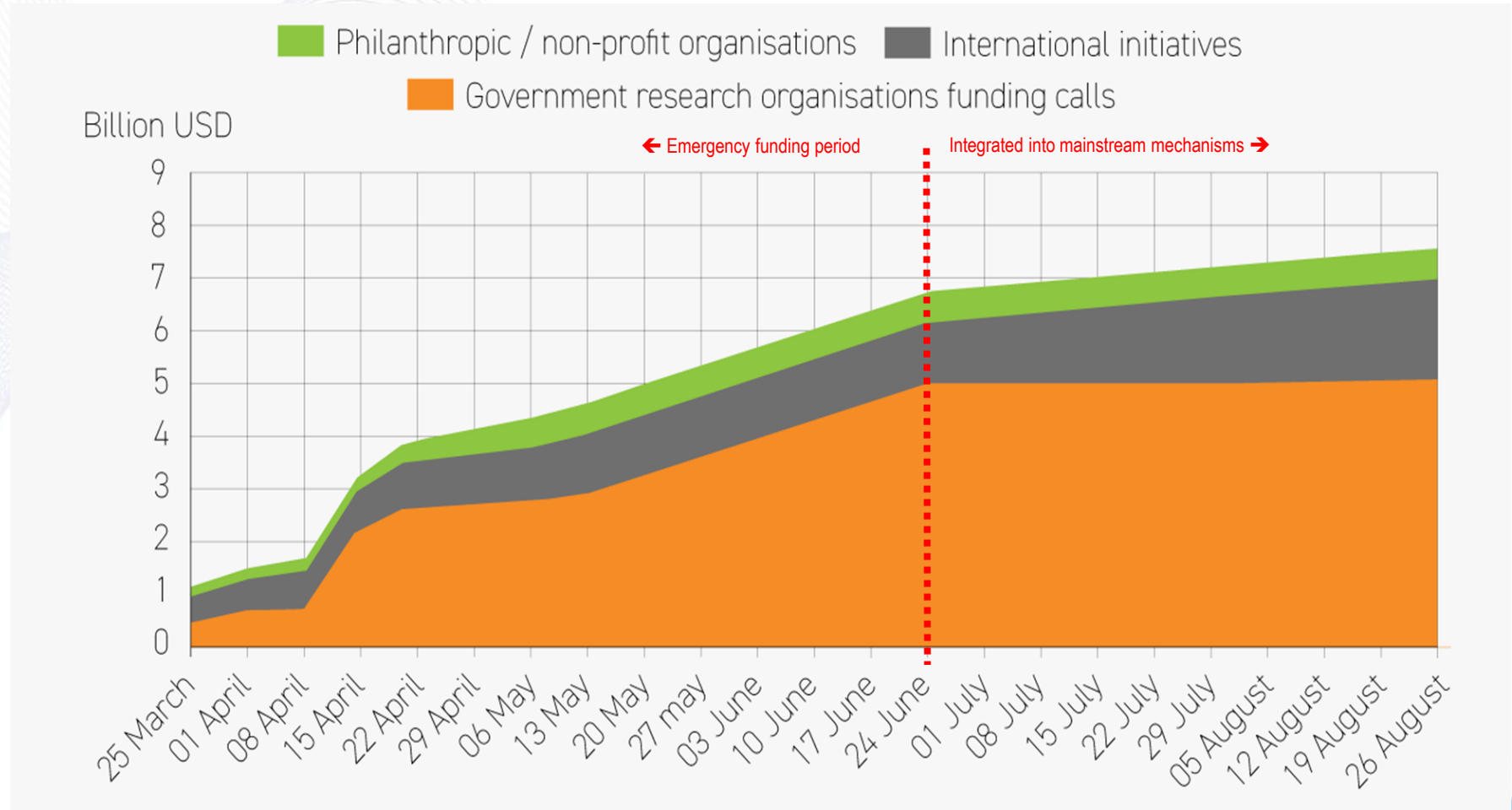


Research funding response to COVID-19

Evolution of COVID-19 research funding programmes and pledges

Funding for research and innovation has been supported by active government interventions around the world

But there are risks of indiscriminate diversion of research efforts



Source: Data gathered by OECD from public sources published by funders

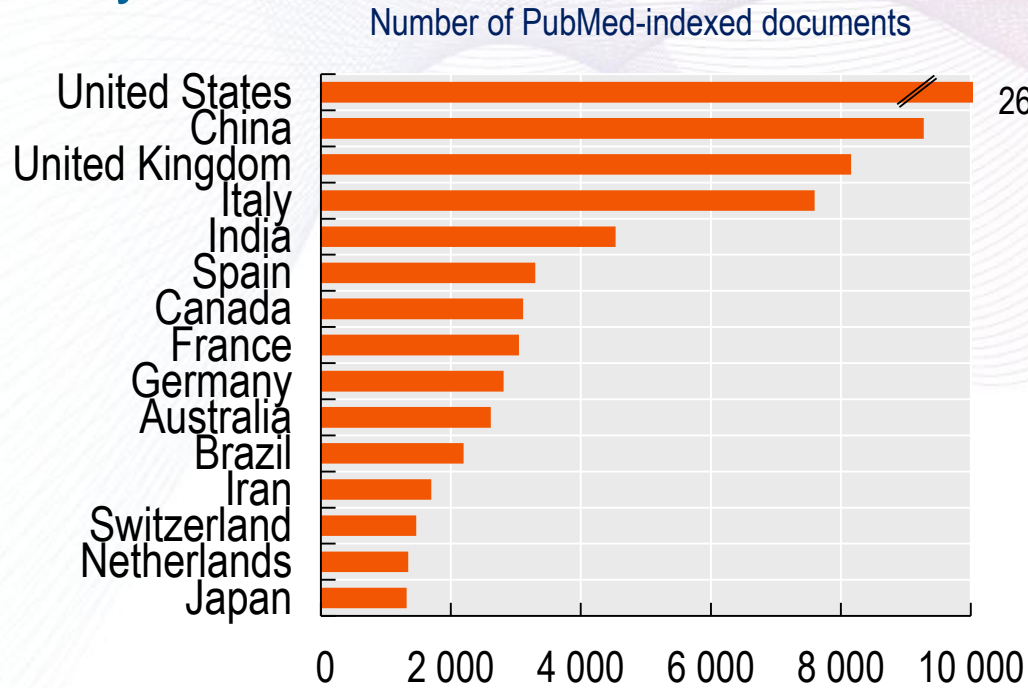




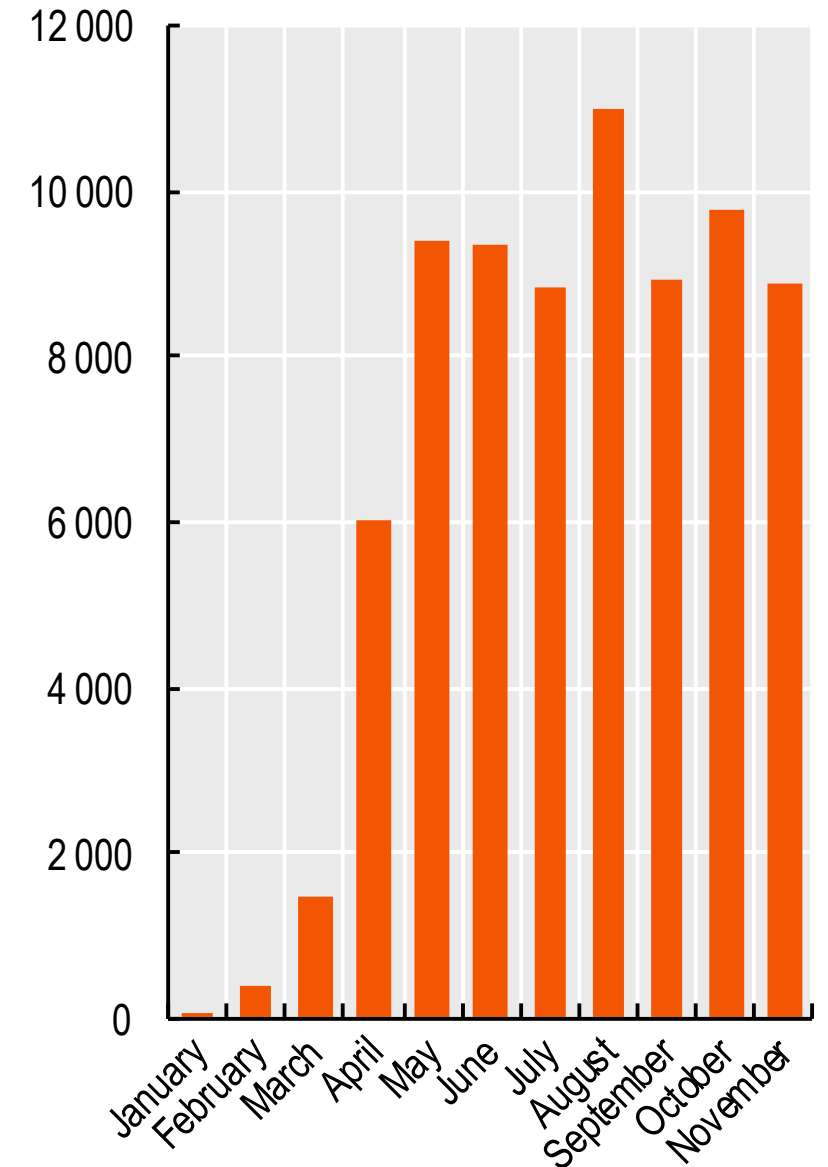
Research performers' response to COVID-19

Trends in COVID-19 biomedical and life sciences research publications, 1 Jan to 30 Nov 2020

The COVID-19 pandemic has triggered an unprecedented mobilisation of the scientific community



Number of PubMed-indexed documents, whole counts



Source: OECD calculations based on US National Institutes of Health PubMed data, <https://pubmed.ncbi.nlm.nih.gov/>, (accessed 30 November, 2020).



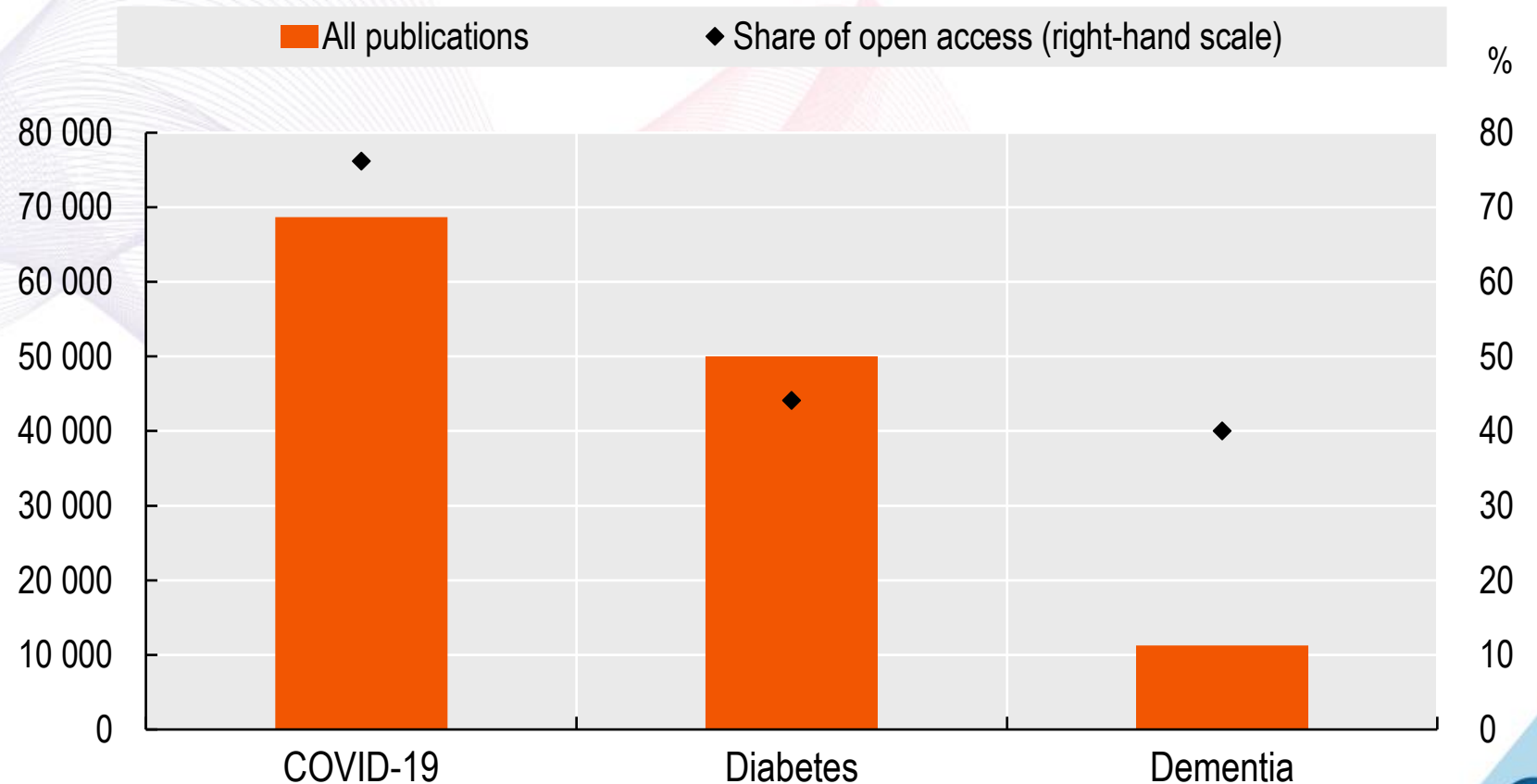


COVID-19 is an accelerator of trends already underway

76% of COVID-19 scientific publications are open access, c.f. diabetes (43%) and dementia (40%)

This, along with other changes, could accelerate the transition to a more open science in the longer run

Open access of COVID-19, Diabetes and Dementia publications, January-October 2020

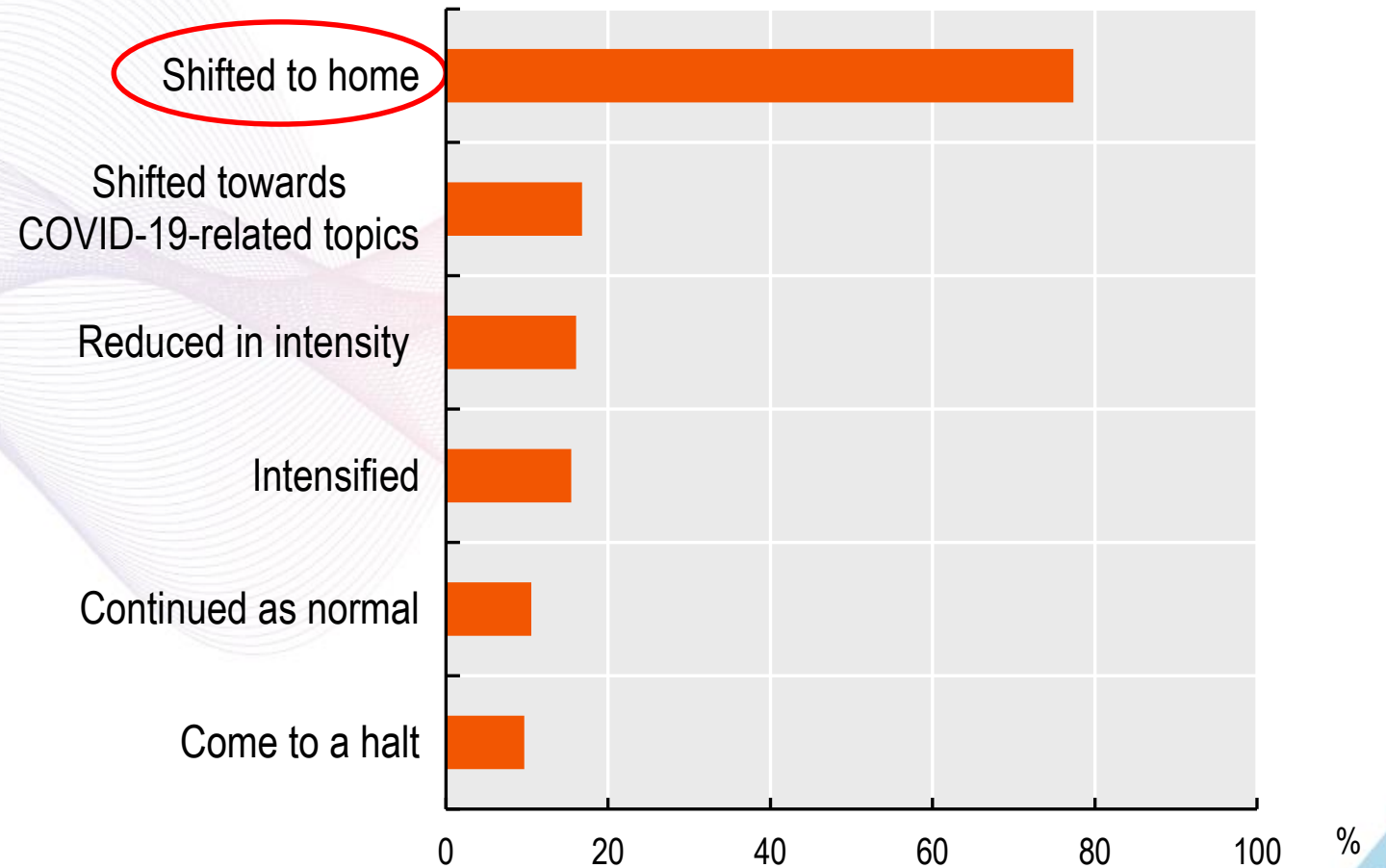




COVID-19 as an accelerator of trends already underway

- Research and innovation activities have been severely disrupted by lockdowns and social distancing measures

Current impact of COVID-19 on scientists' work



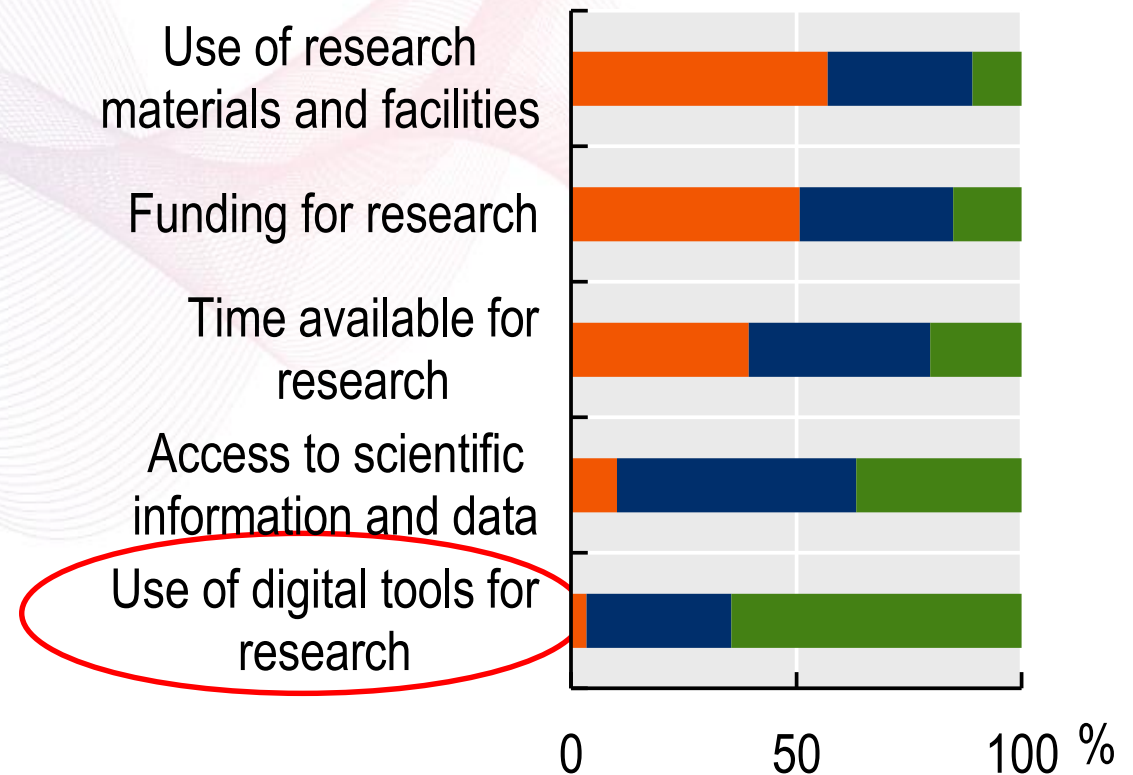


COVID-19 as an accelerator of trends already underway

- Research and innovation activities have been severely disrupted by lockdowns and social distancing measures
- Digital tools and open-data infrastructures have allowed scientists to continue to function outside their usual laboratory or field environments

Impact of COVID-19 on scientists' work

Decrease Stay the same Increase

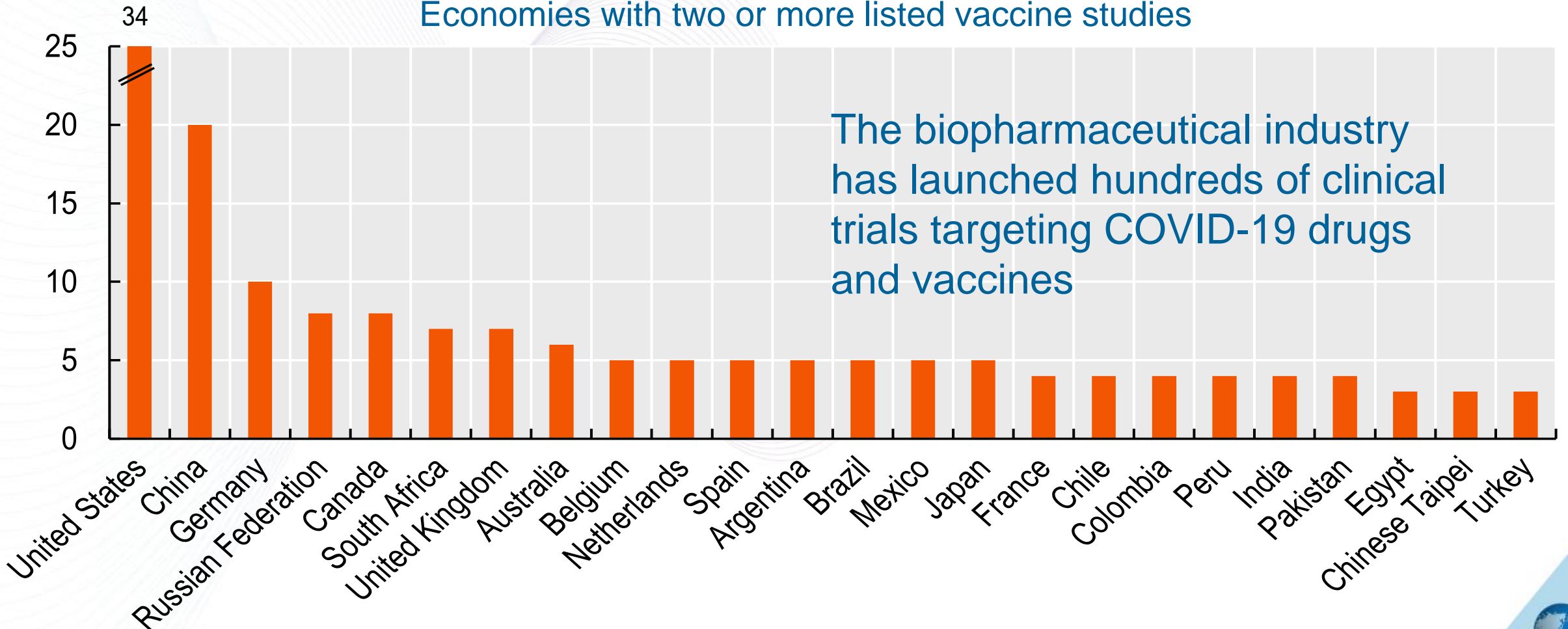




Business innovation response to COVID-19

Registered COVID-19 vaccine studies by economy

Economies with two or more listed vaccine studies



Source: United States National Institutes of Health, ClinicalTrials.gov, (accessed 8 December, 2020).

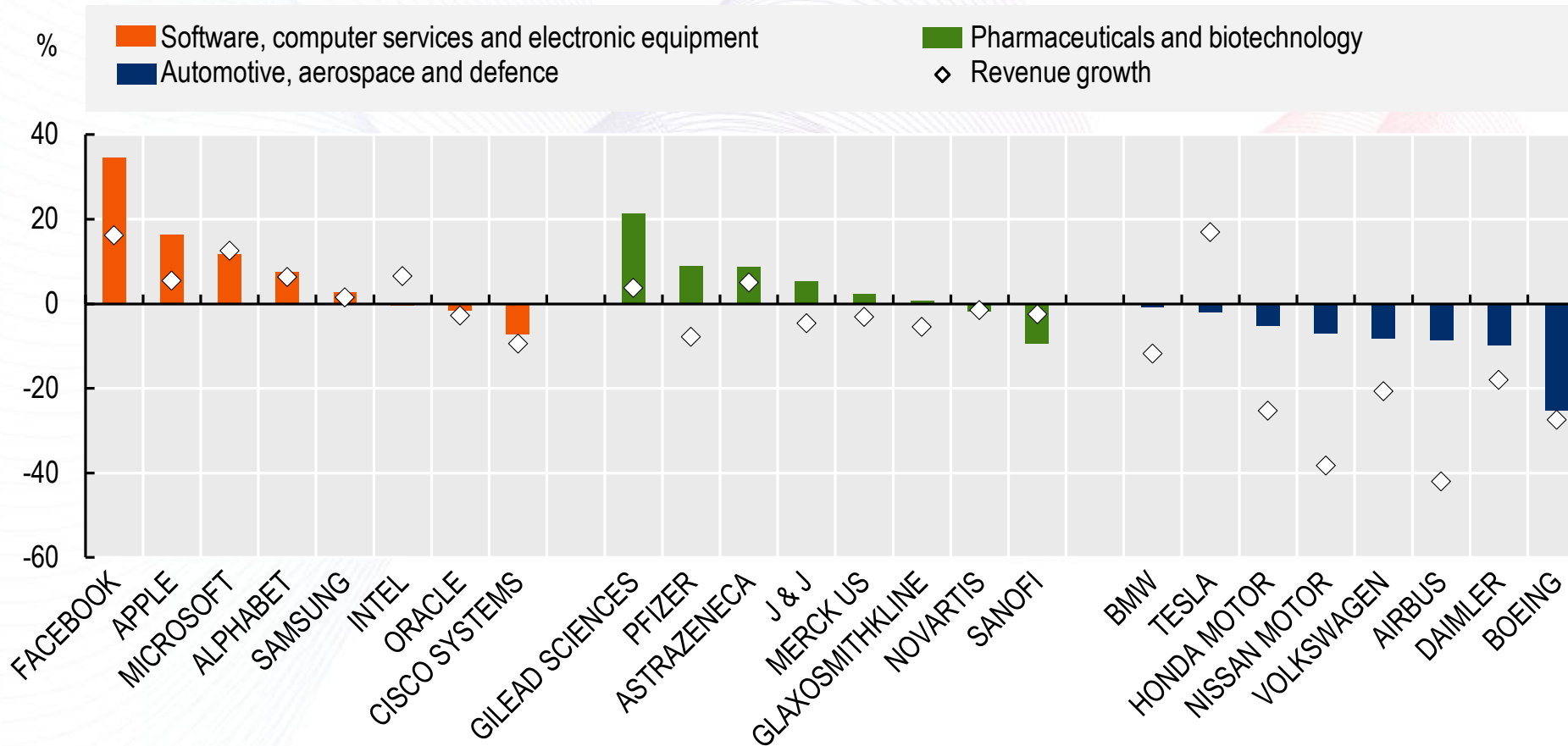




Business innovation response to COVID-19

R&D expense and revenue growth in selected companies

Percentage change between April-September 2019 and April-September 2020

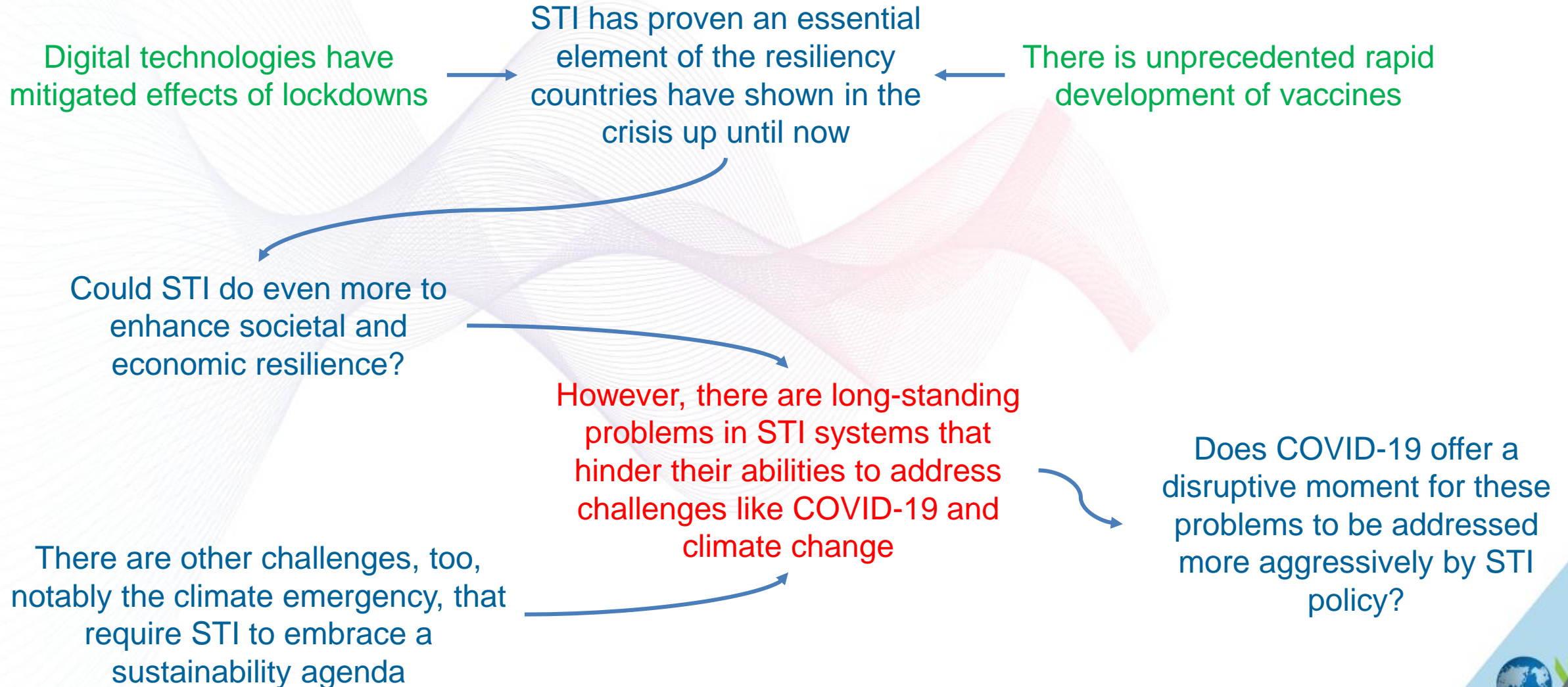


Heterogeneous impact with R&D performance in the digital sector thriving and activity in R&D-intensive manufacturing sectors falling (e.g. automotive, electronics)





Are we facing a turning point for STI policy?





Looking forwards, to tackle the challenges of sustainability, inclusivity and resiliency, governments will need to reorient their STI policies



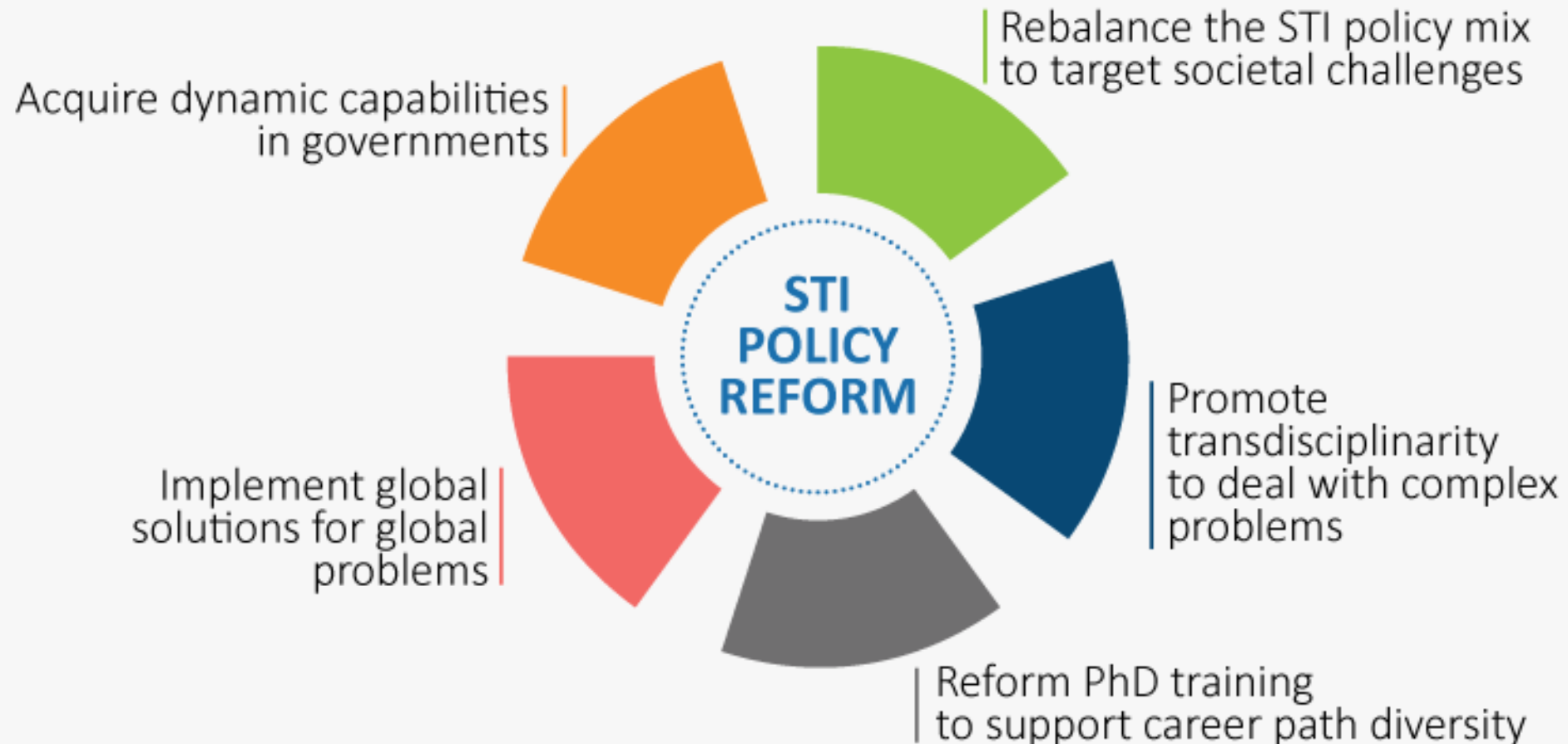
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The need to reorient STI policies

The pandemic is an opportunity to reorient STI policies and trajectories

Main elements of STI policy reform to tackle the challenges of sustainability, inclusivity and resiliency



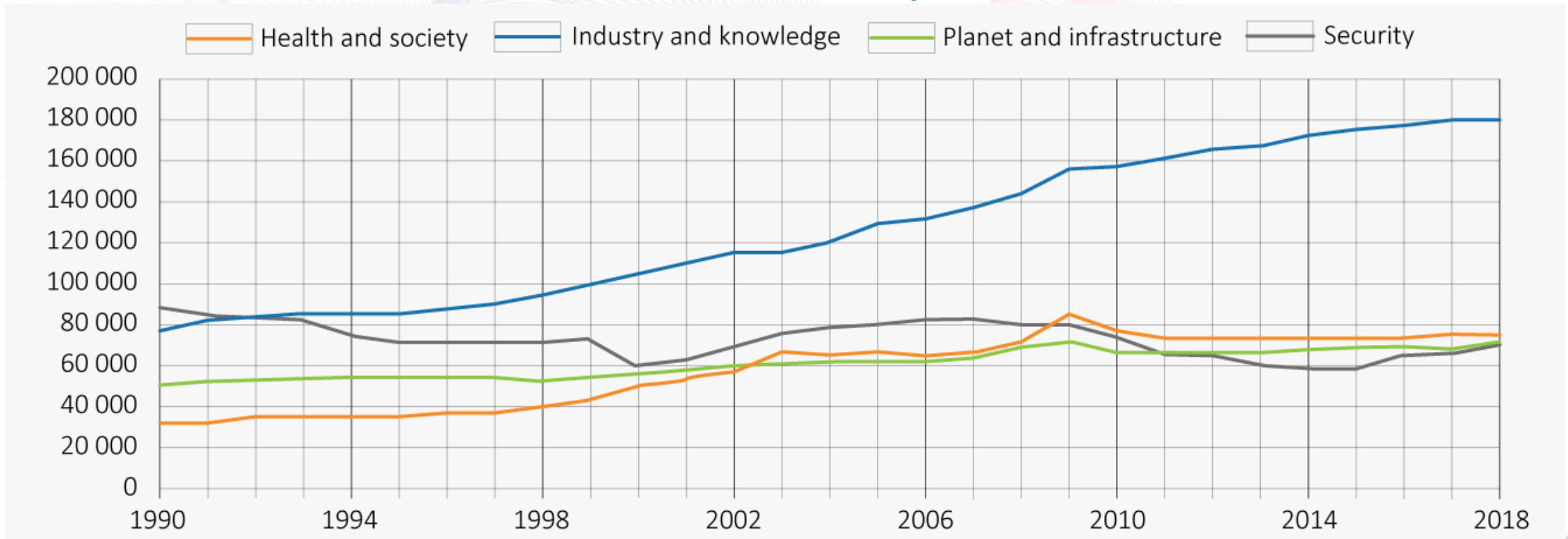


The need to redirect govt support to societal challenges?

Much of the growth in govt spending on R&D over the last two decades has been directed towards industrial R&D (through tax incentives) and research in universities

Estimates of total government support for R&D by SDG-related cluster categories, 1990-2018

Million constant USD PPP prices





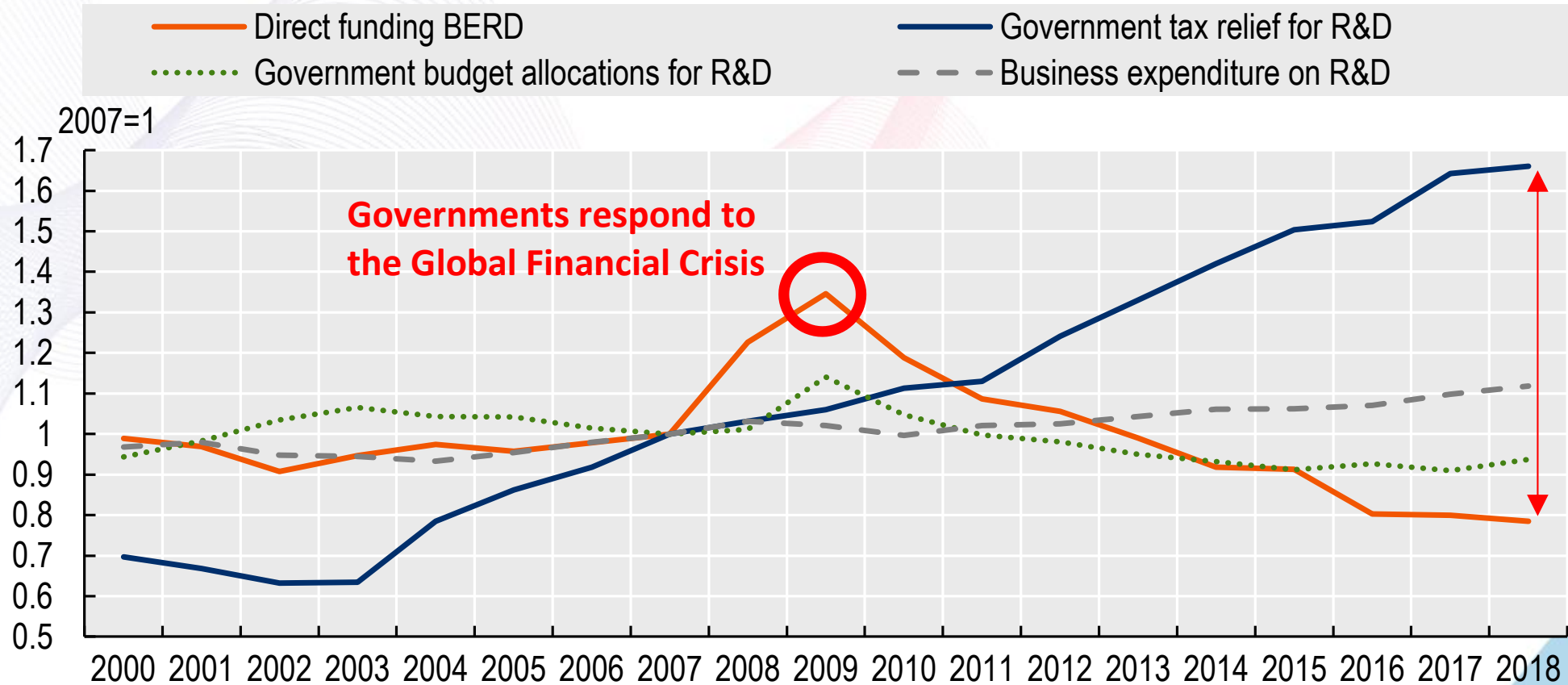
Moving towards a more targeted policy mix

Tax incentives have grown in the OECD while direct measures have declined

A new ambitious policy agenda is crucial for ensuring directionality

Govt spending on R&D will also need to be defended

Shift in business R&D support policy mix OECD area, 2000-19



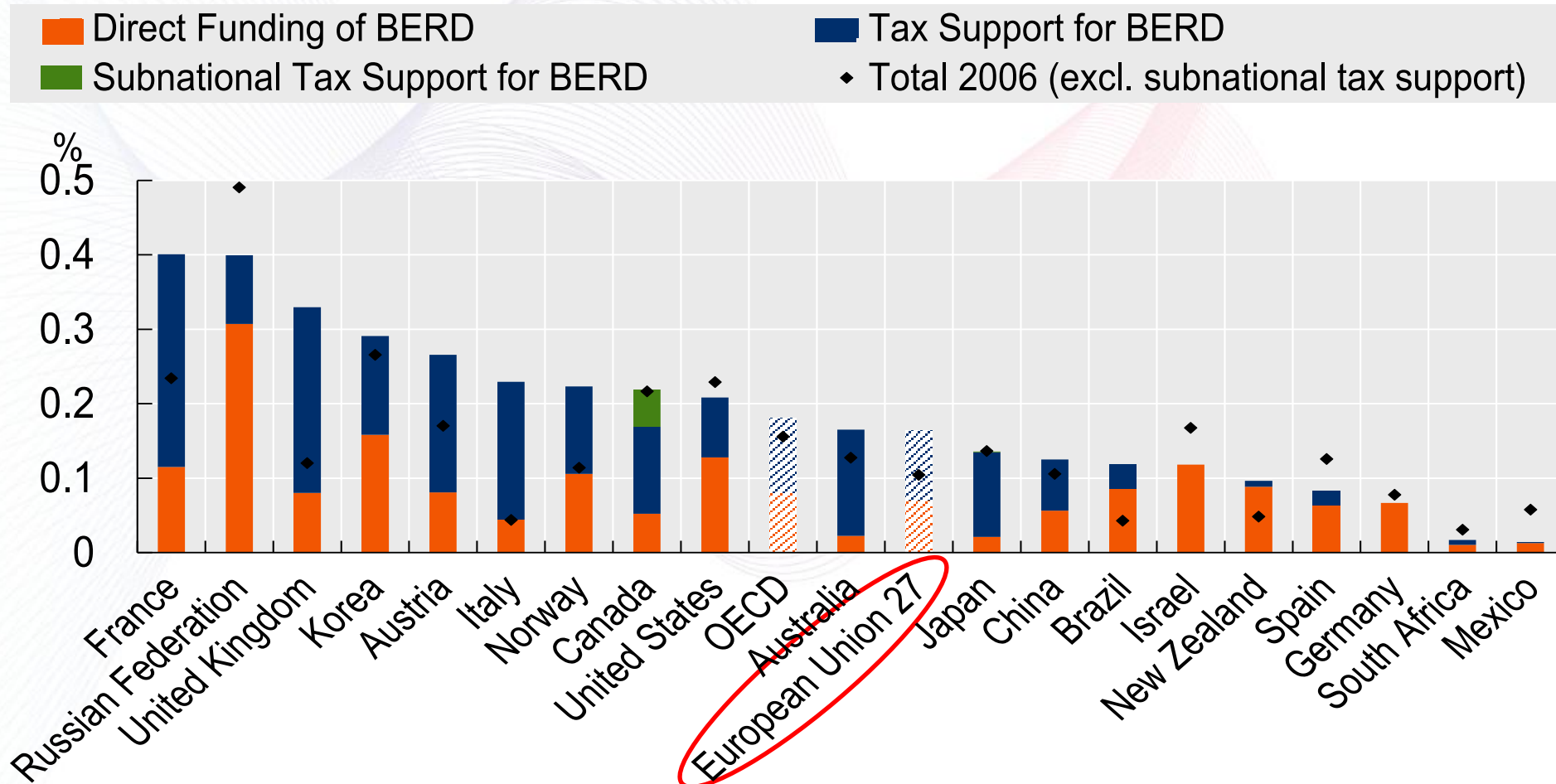
Source: OECD R&D Tax Incentives Database, August 2020, <http://oe.cd/rdtax>





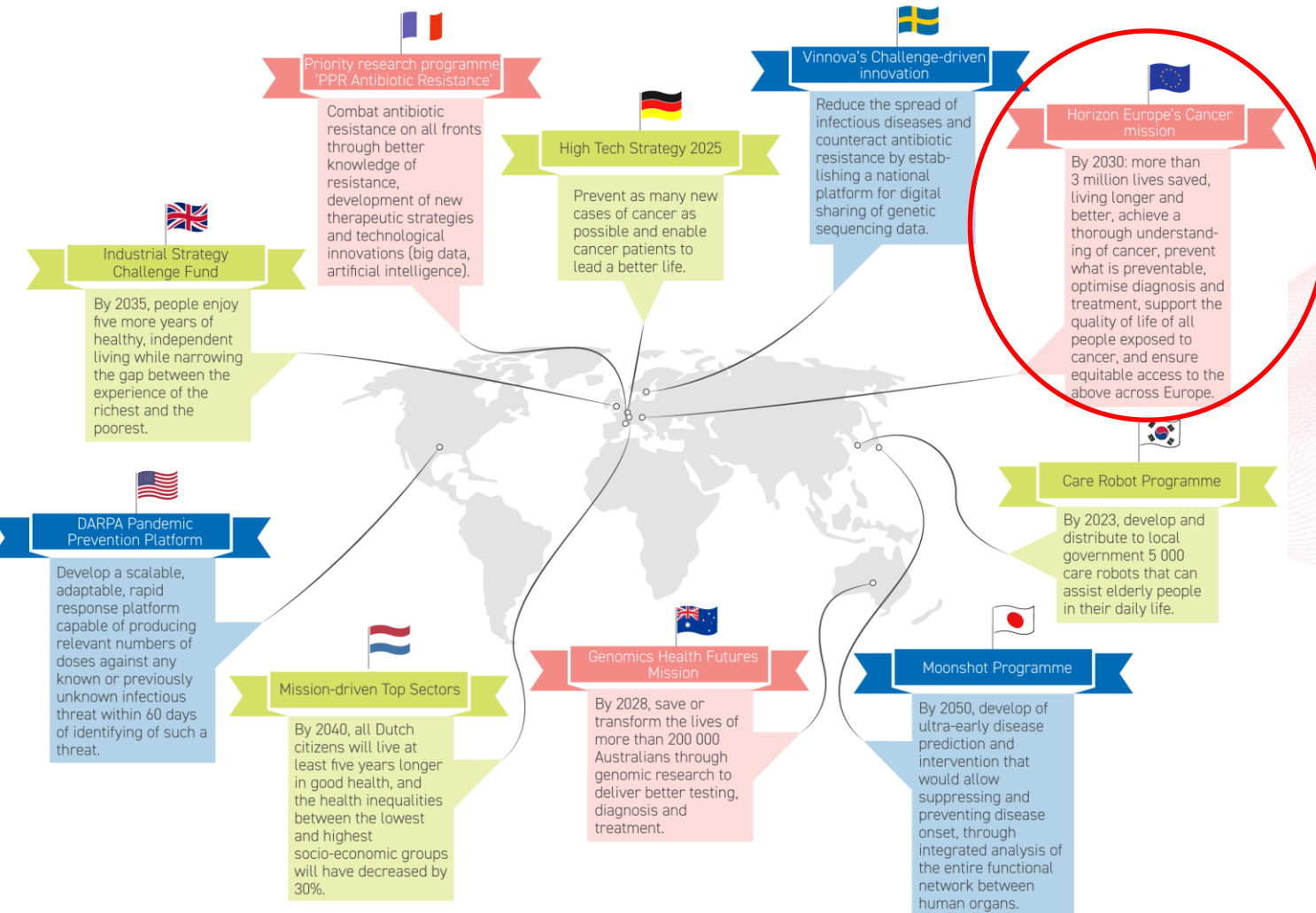
The use of tax incentives varies greatly across the EU27

Direct government funding and government tax support for business R&D (BERD) 2018 and 2006





We need systemic policies to solve systemic problems



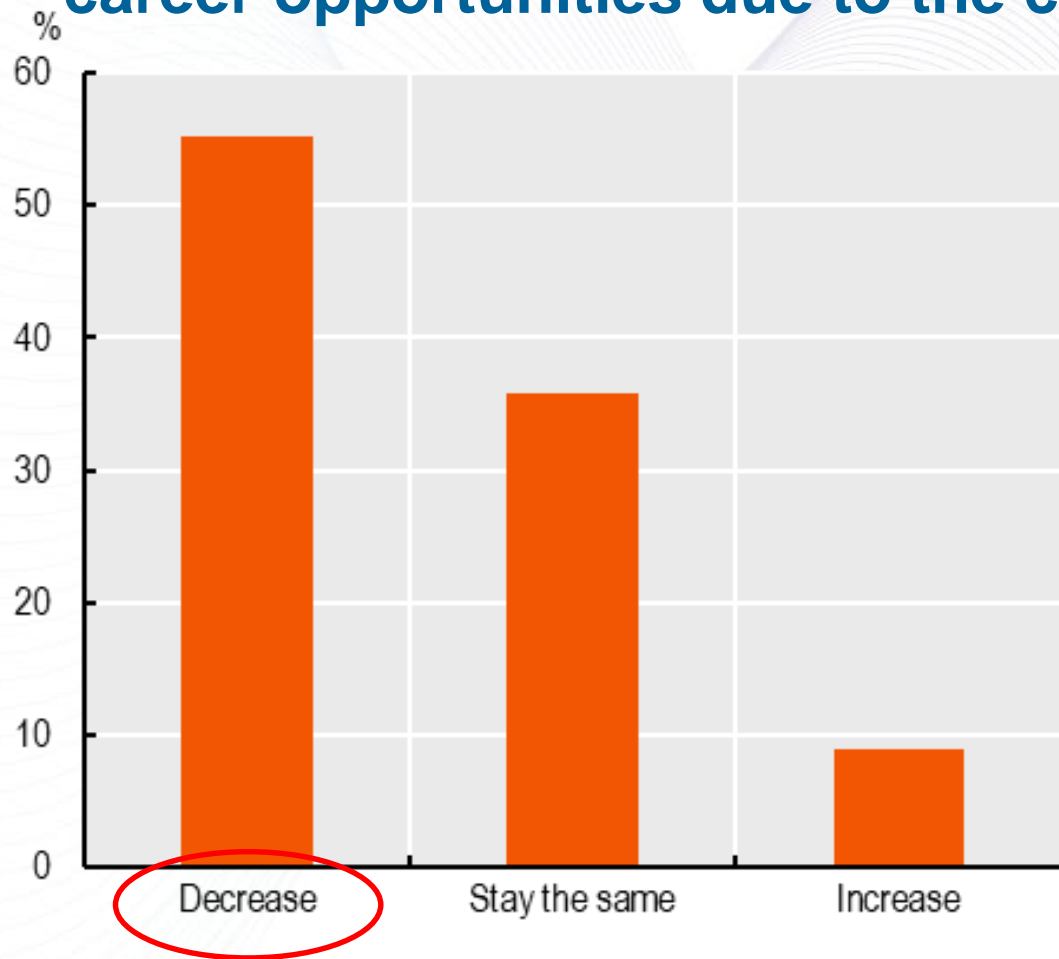
- There has been a recent surge of mission-oriented innovation policies, with different missions and designs
- One common principle: better targeted and coordinated interventions across all silos, for enhanced impact
- The EC's Horizon Europe has ambitious mission-oriented innovation policies, e.g. targeting cancer





Reforming research careers to support diverse pathways

% of scientists who experienced or expect change in their job security and career opportunities due to the current pandemic crisis



Reforming PhD and post-doctoral training to support a diversity of career paths is essential for improving the ability of societies to react to crises like COVID-19, and to deal with longer-term challenges like climate change that require science-based responses

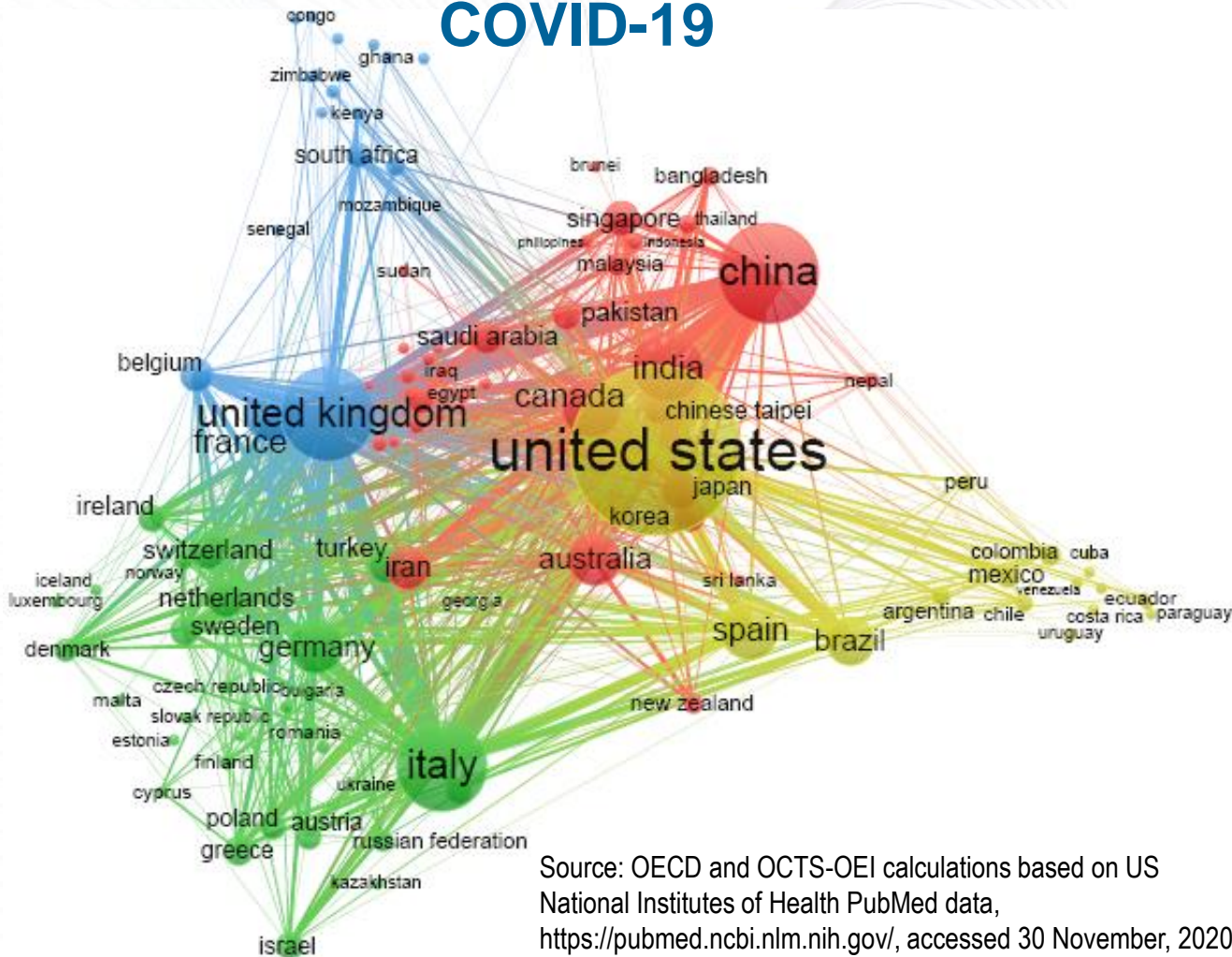
OECD Science Flash Survey 2020,
<https://oecdsciencesurveys.github.io/2020flashsciencecovid/>,
accessed on 12 October 2020





International science collaboration has been critical

International scientific collaboration on COVID-19



Source: OECD and OCTS-OEI calculations based on US National Institutes of Health PubMed data, <https://pubmed.ncbi.nlm.nih.gov/>, accessed 30 November, 2020.

Science depends on the global knowledge commons for progress

A lot of international scientific cooperation on COVID-19 has been initiated by researchers themselves, and has built on existing ties

Research links between China and OECD countries have grown strongly in recent years, and this is reflected in patterns of COVID-19 co-publication



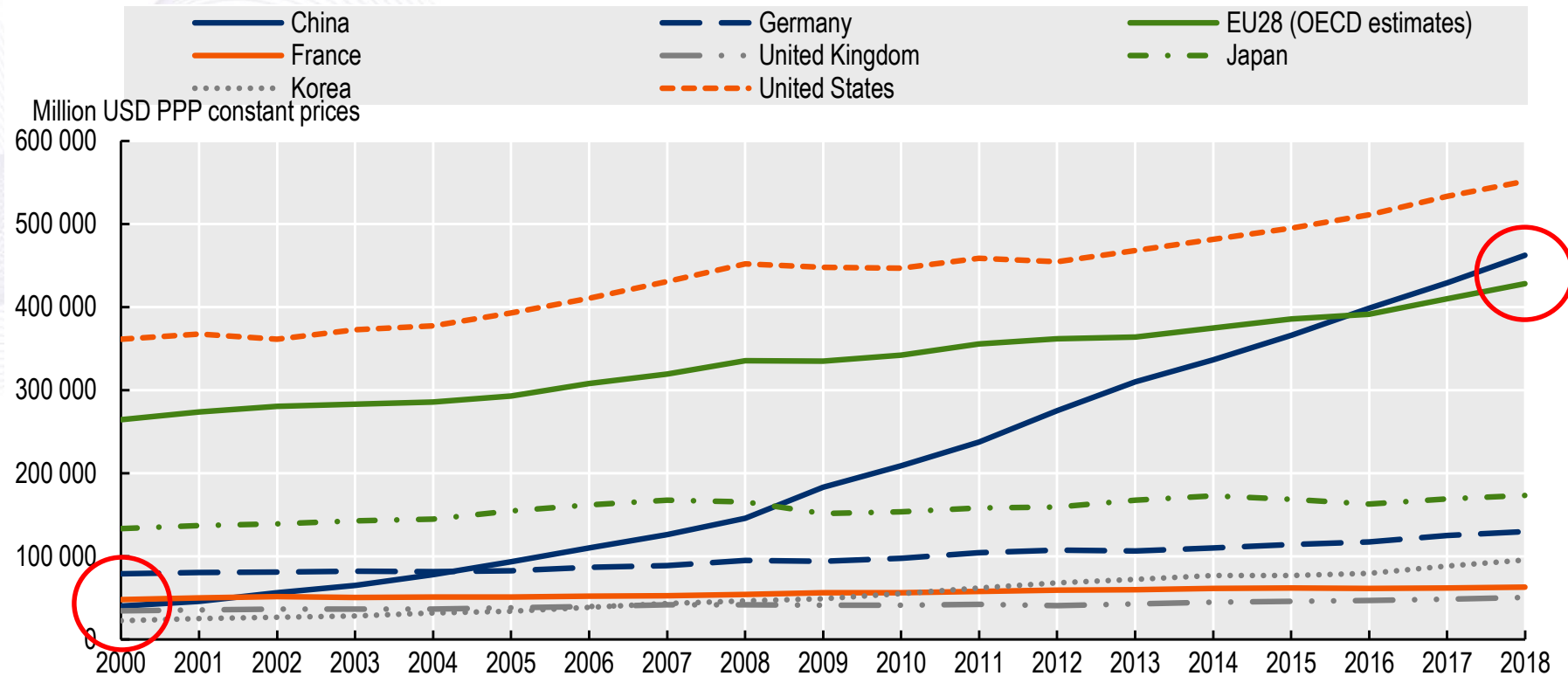


The ascendancy of China

The prominence of China in these links is hardly surprising

China has become the world's second-largest R&D performer – 80% of the expenditure of the United States in 2018

Gross Domestic Expenditure on R&D (GERD), 2000-18



But there are concerns about a lack of reciprocity in these relationships that threaten their future





Acting globally to solve global problems is critical

The ACT-Accelerator is driving unprecedented collaboration



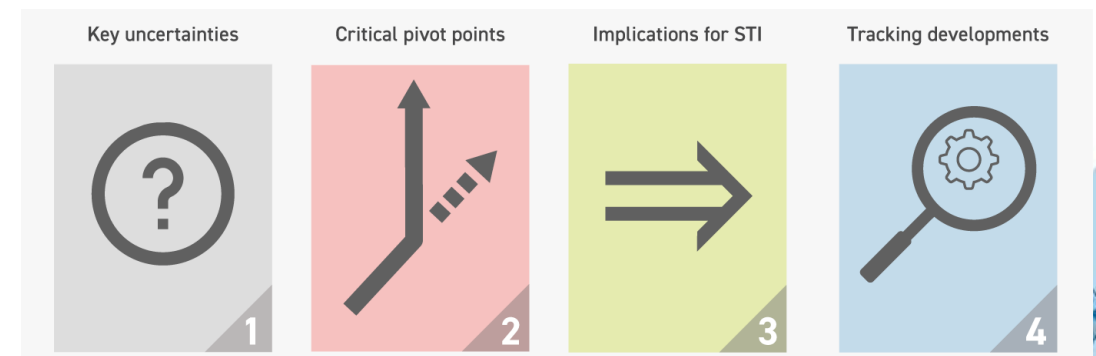
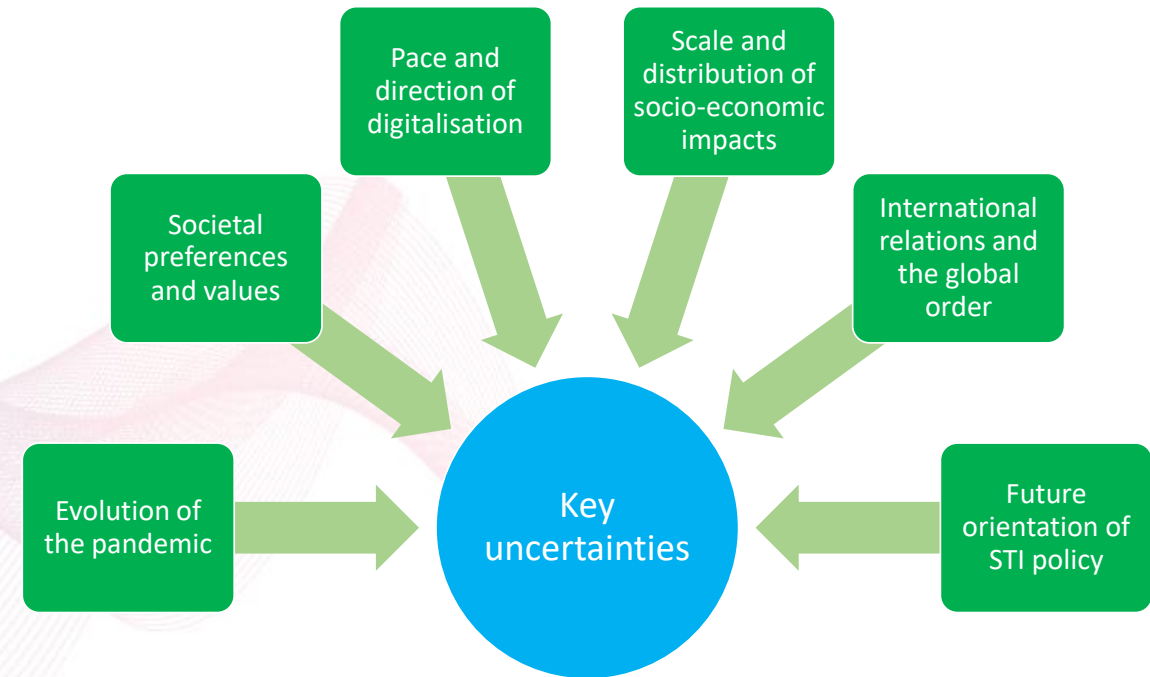
- Just as the pandemic is a global problem, it requires global solutions involving international STI co-operation and collaboration
- The impressive speed on vaccines has built on nascent global co-operation to develop new technology platforms to tackle emerging disease . . . and years of basic research funding
- There are surely lessons for tackling other global challenges





Building dynamic capabilities in government to meet the challenges ahead

- Many key uncertainties remain over the next few months and years
- Governments will also need to prepare more effectively against future shocks
- An increased policy emphasis on building resiliency => requires increased policy agility => and means governments need to possess the dynamic capabilities to adapt and learn in the face of rapidly changing conditions





OECD STI Outlook – take-away messages for the EU



The policy mix for business support – has Europe gone too far on R&D tax credits?



Missions: still lots to learn on how to do this – how can they maximise impact, citizen's engagement and EU-MS joint efforts?



Scaling of start-ups – still a big problem for Europe in turning strong science into commercial success (role of European Innovation Council?)



Fundamental science – important, but a good mix is needed – does Europe have this right?



Reform of STI systems – essential to make the most of the massive European investments, e.g. through Next Generation EU

#NextGenerationEU

Transformative R&I policy – how will Europe equip itself to (re-)tune its STI policies to the changing times?





Learn more in the 'dual format' OECD STI Outlook

OECD Science, Technology and Innovation Outlook 2021
TIMES OF CRISIS AND OPPORTUNITY

Science advice in times of COVID-19

Science advice in times of COVID-19

Scientific evidence related to COVID-19 is conditional and dynamic. In this situation, science advice at any one point in time should be based on best available evidence but will nevertheless involve considerable uncertainties that need to be openly communicated to policy-makers and the public.

What's at stake?

The important question for scientists and policy-makers is how they can most effectively work together to develop and implement policies that have the greatest likelihood of success in limiting mortality and severe socio-economic damage due to COVID-19, in a situation where much of the evidence is uncertain and rapidly evolving?

Moreover, no matter what the evidence base, the policies that are selected need to be understood and adopted by citizens, which means that those providing the evidence need to be trusted. Ultimately, it comes down to individual scientists to provide scientific advice to policy makers and communicate this advice to the public. The selection of these individuals is absolutely critical and is an area in which many countries appear to have made judicious choices in the COVID-19 context.

However, even the most outstanding individual scientists, with the most accomplished communication skills, cannot assure that the best evidence informed policies are adopted and implemented. They need to be supported by an effective national (and international) science advisory system that should comply with a number of basic principles, as shown in the figure (OECD, 2015). Attention to these principles will both enhance the efficiency and quality of the science advice that is provided and help ensure the necessary trust between scientists, policy-makers and the public.

An effective and trustworthy science advisory process

- 1 Have a clear remit, with defined roles and responsibilities for its various actors.**
This includes having:
 - a. a clear definition and, insofar as possible, a clear demarcation of advisory versus decision-making functions and roles,
 - b. defined roles and responsibilities and the necessary expertise for communication,
 - c. an ex ante definition of the legal role and potential liability for all individuals and institutions that are involved,
 - d. the necessary institutional, logistical and personnel support relative to its remit.
- 2 Involve the relevant actors – scientists, policy-makers and other stakeholders, as necessary. This includes:**
 - e. using a transparent process for participation and following strict procedures for declaring, verifying and dealing with conflicts of interest,
 - f. engaging all the necessary scientific expertise across disciplines to address the issue at hand,
 - g. giving explicit consideration to whether and how to engage non-scientific experts and/or civil society stakeholders in framing and/or generating the advice,
 - h. having, as necessary, effective procedures for timely exchange of information and co-ordination with different national and international counterparts.
- 3 Produce advice that is sound, unbiased and legitimate.**
Such advice should:

Research precariat

The Precarity of Research Careers

Should I stay or should I go? Deteriorating working conditions for academic researchers may push the best talent to go elsewhere. Academic structures that mainly link training and careers to 'research excellence', as measured by publication outputs - are not fully adequate to meet the future needs of science and of society as a whole. This poses several important questions for STI policy.

What's at stake?

Researchers are the most important resource of research systems, and, as in other areas of activity, people are a key determinant of performance. The quality of the research produced depends mostly on the expertise and skills of the researchers, both individually and collectively, and the conditions given to them to perform their work.

Many OECD countries are preoccupied with the future of academic research careers. Their concerns relate to the deterioration of working conditions of many researchers, lack of diversity in terms of gender and representation of different groups in society, unequal opportunities in access and advancement in careers, and declining capacity of research systems to attract the best national and international talent.

The move away from core basic funding to project-based funding is making research systems increasingly dependent on a cohort of junior staff employed on casual contracts. Furthermore, the contest for funding and the development of research assessment regimes puts emphasis on the short-term output of research, which places immense pressure on early career researchers to publish.

The traditional academic career path can no longer absorb the increasing number of doctorate holders in many systems, which is heightening career competitiveness to extreme levels and contributing to greater precarity. A possible solution is to prepare doctorate holders for diverse careers beyond the traditional academic career path. However, the attractiveness of alternative careers vis-à-vis the academic career path may take away the best talent from academic research, and impair the long-term quality of the science produced.

The OECD Global Science Forum is undertaking a project on **reducing the precarity of research careers**. Its main objective is to identify policies and procedures that could support better strategic planning and management of research careers in the public sector, promoting inclusion and diversity, while increasing the quality of the science produced and the well-being of researchers. The project focuses on a particular group of researchers, the Research Precariat. These researchers are mainly postdoctoral researchers, waiting to enter the academic career as a researcher in a public research organisation, or the professoriate in a university.

The Research Precariat can be defined as the population of researchers with a doctoral degree that hold temporary positions without any commitment to renew their positions or transform those positions into long-term or permanent contracts.

Book

Website online: oe.cd/sti-outlook





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OECD-Ausblick Wissenschaft, Technologie und Innovation 2021
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Science, technologie et innovation : Perspectives de l'OCDE 2021
AFFRONTER LA CRISE ET SAISIR LES OPPORTUNITÉS



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Perspectivas de la OCDE sobre Ciencia, Tecnología e Innovación 2021
OPORTUNIDADES EN TIEMPOS DE CRISIS



OCDE

The COVID-19 crisis has **accelerated trends** already underway in STI...

Around **75 000** scientific publications on COVID-19 were published in 11 months, of which more than **75% were open access**.

Stay the same, Decrease, Increase. Use of digital tools for research as a consequence of the crisis.

Two-thirds of scientists experienced, or expected to see, an increase in the use of digital tools for research as a consequence of the crisis.

These developments could speed the transition to a more open science and innovation in the longer run.

...while **international collaboration** has been key to the STI response to COVID-19.

By August 2020, about **USD 2 billion** from both public and private sources had been pledged for international research efforts, largely targeted to develop COVID-19 vaccines.

Gross Domestic Expenditure on R&D, 2000-18 (Million USD PPP constant prices)

Year	United States	China	EU28
2000	~100,000	~10,000	~50,000
2005	~150,000	~20,000	~70,000
2010	~200,000	~30,000	~100,000
2015	~250,000	~100,000	~130,000
2018	~280,000	~200,000	~150,000

China has become the world's second-largest R&D performer, having 80% of the expenditures of the United States in 2018.

Proportion of PubMed-indexed COVID-19-related documents attributed to the US and China (Jan-Nov 2020)

Country	Proportion
United States	36.0%
China	12.5%

The United States accounts for the largest share of COVID-19 publications, followed by China.

The United States and China are one another's top research collaborators on COVID-19.

Responses to the crisis have drawn upon the **innovative potential of businesses**.

The private sector has delivered a wide range of innovative solutions to help cope with the health emergency, and many firms have expanded their use of digital technologies.

The biopharmaceutical industry, often in partnership with academia, has played a particularly crucial role, launching hundreds of clinical trials targeting COVID-19 drugs and vaccines.

The pandemic is a **stark reminder of the need to transition to more sustainable, equitable and resilient societies**. Science and innovation are essential to promote and deliver such transitions, but need to be reoriented.

Global challenges require global solutions that draw on international STI co-operation. However, governments need to build trust and define common values to ensure a level playing field for scientific co-operation.

2006 | 2017. Tax support represented around 55% of total government support in 2017, compared to 36% in 2006.

Governments may need to rebalance their policy portfolios away from tax measures towards direct funding.

Change in job security and career opportunities (% of scientists)

Category	Percentage
Decrease	~55%
Stay the same	~35%
Increase	~10%

Reforming PhD training to support a diversity of career paths is essential for improving societies' ability to react to crises and to deal with long-term challenges like climate change. **More than half** of the scientists participating in the OECD Science Flash Survey expect the crisis to negatively affect their job security and career opportunities.





STIP COVID-19 Watch: Stay informed on countries' STI policies to tackle COVID-19



<https://stip.oecd.org/covid/>

- Get the latest information on STI policy responses to the crisis across **+40 countries** and the EU, with timelines and other interactive charts
- Featuring information on **700 STI policy initiatives** targeting scientific advice and communication, collaboration mechanisms, new funding initiatives, impacts on the STI system, etc.

Search
Search by policy initiative title...

Territories
Filter by territory...
• Select at least 2 countries to display comparison timeline

Themes
Filter by theme...

Policy instruments
Filter by policy instrument...

Target groups
Filter by target groups...

Budget ranges
Filter by budget range...

695 policy initiatives found

- European Open Science Cloud: Coronavirus actions**
European Union Mar 20
Open science measures
POLICY INSTRUMENTS
Information services and access to datasets
- OpenAIRE COVID-19 research data entry point**
European Union Mar 20
Open science measures
POLICY INSTRUMENTS
Information services and access to datasets
- Innovative Medicines Initiative special fast track call**
European Union Mar 20
Support for research and innovation
BUDGET RANGE
20M-50M
POLICY INSTRUMENTS
Project grants for public research
- CPC Common Position COVID-19**
European Union Mar 20
Scientific advice and communication arrangements
POLICY INSTRUMENTS
Public awareness campaigns and other outreach activities

Timeline: Jan 20 (26), Feb 20 (45), Mar 20 (236), Apr 20 (161), May 20 (56), Jun 20 (38), Jul 20 (23), Aug 20 (14), Sep 20 (13), Oct 20 (12), Nov 20 (6), Dec 20 (1)

THANK YOU!

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