OECD Science, Technology and Innovation Outlook 2021

TIMES OF CRISIS AND OPPORTUNITY

HIGHLIGHTS

Read the full publication at: *https://doi.org/10.1787/75f79015-en*.

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The *OECD Science, Technology and Innovation Outlook 2021* is the latest in a series that reviews key trends in science, technology and innovation (STI) policy in OECD countries and several major partner economies.

This edition focuses on the COVID-19 pandemic, which has triggered an unprecedented mobilisation of the science and innovation community. Public research agencies and organisations, private foundations and charities, and the health industry 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. They have played essential roles in providing a better understanding of the virus and its transmission, and in developing hundreds of candidate vaccines over a very short period. The pandemic has underscored more than in other recent crises the importance of science and innovation to both preparing for and reacting to upcoming crises.

The pandemic has also stretched research and innovation systems to their limits, revealing gaps that need filling to improve overall system resilience to future crises. It is a wake-up call that highlights the need to recalibrate STI policies so that they better orient research and innovation efforts towards sustainability, inclusivity and resiliency goals.

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

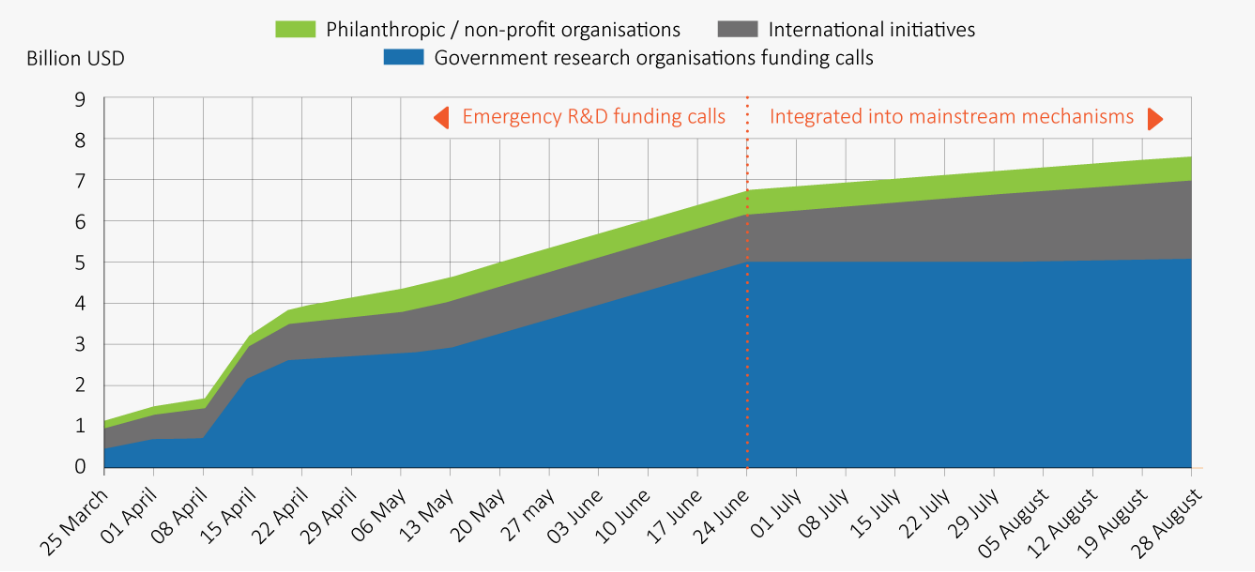
Research and innovation systems have, in many ways, responded impressively to the pandemic. Vaccine candidates with high reported efficacy have been developed with unprecedented speed. At the same time, COVID-19 has tested the limits of research and innovation systems, demonstrating their inherent capacities and flexibility, but also revealing areas where resilience and future preparedness must improve. The pandemic has been a catalyst accelerating trends already underway, opening access to publications, increasing the use of digital tools, enhancing international STI collaboration, spurring a variety of public-private partnerships and encouraging the active engagement of new players, such as citizen scientists, the maker movement and philanthropies. But the pandemic continues to pose major challenges for innovation systems, endangering key productive and innovation capabilities, especially in hard-hit sectors.

Governments acted quickly to fund COVID-19-related research and innovation at scale

In the first few months of the pandemic, national research funding bodies worldwide spent around USD 5 billion on emergency funding for COVID-19 R&D (Figure 1). That includes about USD 300 million in Asia-Pacific (excluding the People's Republic of China, hereafter China), over USD 850 million in Europe and over USD 3.5 billion in North America. Philanthropic foundations allocated at least USD 550 million to COVID-19 research during this period, on top of their pledges to major international cooperative initiatives. In the second half of 2020, national research funders increasingly integrated calls for COVID-19 R&D into traditional mainstream funding mechanisms, which makes their identification and measurement more difficult. It is unclear whether this came at the expense of funding for other disciplines, and if so, on what scale. Indeed, the widespread engagement of the research community in designing solutions to COVID-19 risks diverting research efforts indiscriminately away from non-COVID-19-related topics.

Figure 1. Evolution of COVID-19 research funding programmes and pledges

March-September 2020



Note: These figures should be treated with caution because of the complexity of mapping funding declarations to actual investment, as well as the absence of data from some countries such as China. Overall investment is almost certainly underestimated as the expected level of funding is not yet fully known or validated for all funding schemes, and some funders do not publicly disclose the sums allocated. Nevertheless, there may also be some duplication when funding commitments are re-distributed to different funding programmes. The sharp increase in funding seen in April is linked to the clarification of resource allocation to major funding programmes by some major research funders.

Source: OECD, Data were gathered from public sources published by funders.

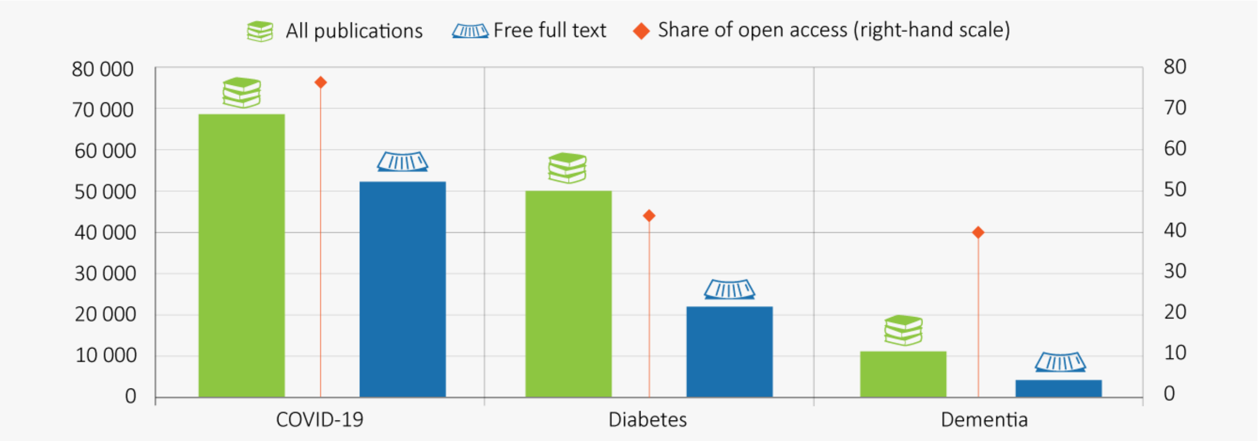
StatLink https://doi.org/10.1787/888934223232

The pandemic has triggered an unprecedented mobilisation of the scientific community

Around 75 000 scientific publications on COVID-19 were published between January and November 2020, of which more than three-quarters were open access, compared to less than one-half in other biomedical fields (Figure 2). The United States accounts for the largest share, followed by China and the United Kingdom (Figure 3). Research databases and scientific publishers removed paywalls so that the scientific community could quickly share COVID-19-related data and publications. Pre-prints (academic papers that have yet to be peer reviewed or published) have become more common in the medical research field, allowing for the faster diffusion of scientific findings, but also raising risks around quality assurance. These developments mark important changes that could accelerate the transition to a more open science in the longer run.

Figure 2. Open access of COVID-19, Diabetes and Dementia publications, January-October 2020

Total and free full text PubMed publications

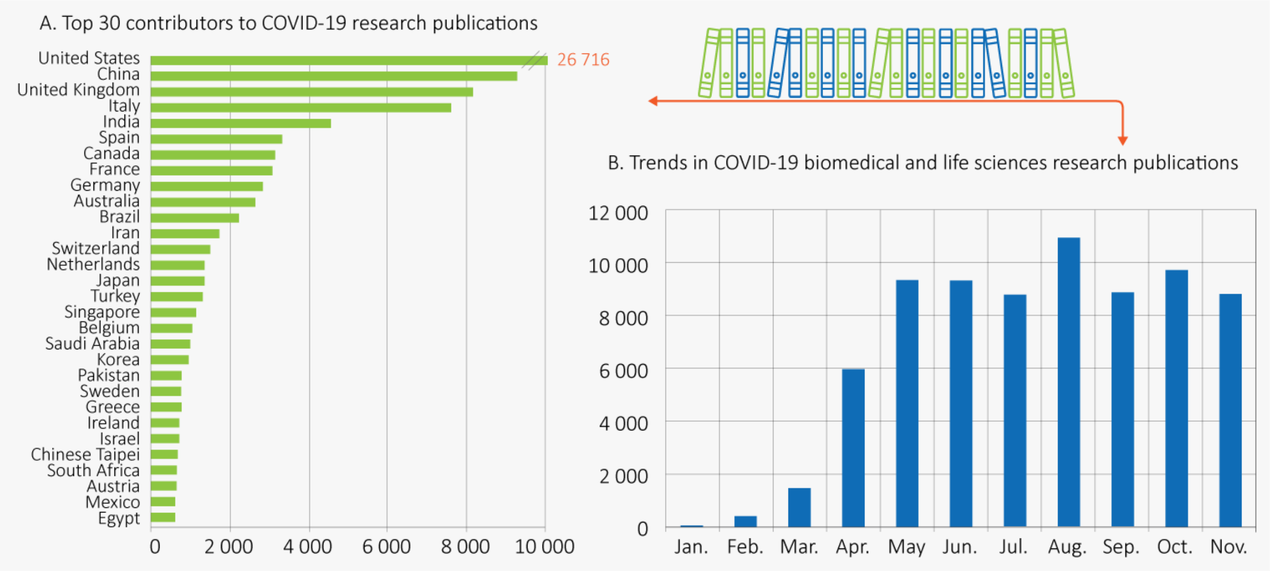


Note: The period covers 1 January to 30 October, 2020. Publications include the following type of peer-reviewed articles: books and documents, clinical trials, meta-analysis, randomised controlled trials, reviews and systematic reviews.

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

StatLink https://doi.org/10.1787/888934223289

Figure 3. Growth in COVID-19 related publications, 1st January - 30 November



Note: The period covers 1 January to 30 November, 2020 and includes 74 115 documents. Publications include the following type of peer-reviewed articles: books and documents, clinical trials, meta-analysis, randomised controlled trials, reviews and systematic reviews.

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).

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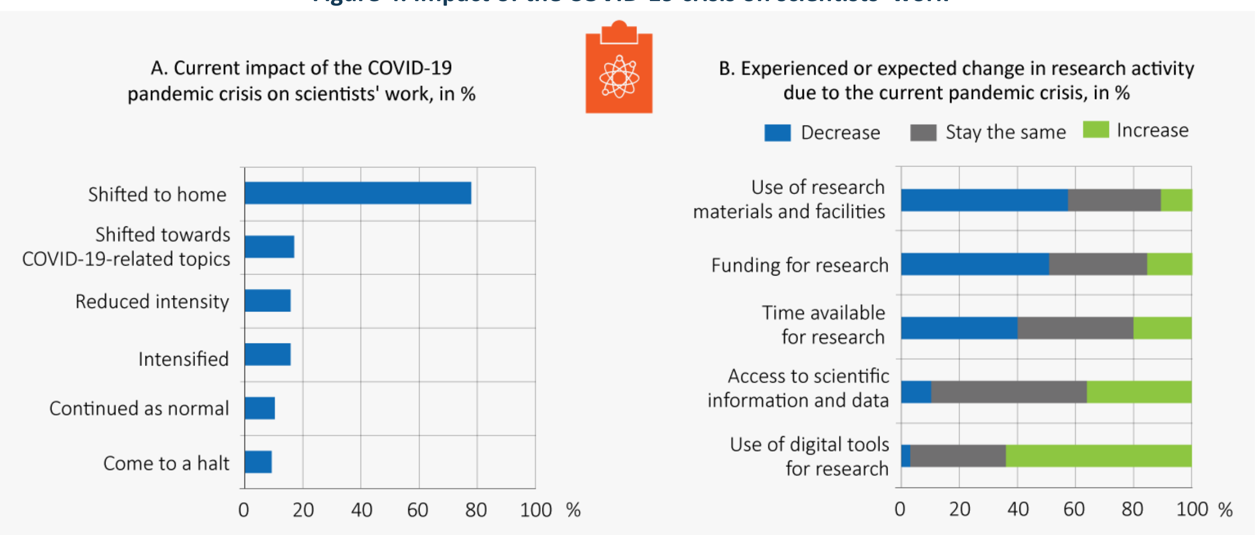
Beyond their research activities, scientists have been called upon to provide expert input on public health and other policy responses to the pandemic. They have had to communicate evidence that is unavoidably incomplete and changing, and to do so in ways that promote public confidence and trust. For various reasons, however, scientific advice to policy makers and the public is increasingly contested, even as governments continue to face new waves of the pandemic. This requires governments to carefully communicate uncertainties, provide a balanced presentation of potential scenarios and be transparent about mistakes. They should also ensure that policies are developed with input from many different types of expertise, including from the social sciences.

Despite the disruption, scientists have continued their work during the crisis

Digital tools and open-data infrastructures have allowed scientists to continue to function outside of their usual laboratory or field environments, many of which have been disrupted by lockdowns. In the OECD Science Flash Survey 2020, more than three-quarters of scientists indicated they had shifted to working from home at some point in 2020, and almost two-thirds experienced, or expected to see, an increase in the use of digital tools for research as a consequence of the crisis (Figure 4).

Figure 4. Impact of the COVID-19 crisis on scientists' work



Note: Panel A shows the percentage of responses from scientists to the statement, "In recent weeks and days, as the COVID-19 emergency intensified, your work has (i) Come to a halt; (ii) Continued as normal; (iii) Intensified; (iv) Reduced in intensity; (v) Shifted towards COVID-19-related topics; and (vi) Shifted to home". Panel B shows the percentage of responses from scientists to the question, "As a result of the current crisis, have you personally experienced or do you expect to experience a change in (i) Use of digital tools for research; (ii) Access to scientific information and data; (iii) Time available for research; (iv) Funding for research; and (v) Use of research materials and facilities?"
Source: OECD Science Flash Survey 2020, https://oecdsciencesurveys.github.io/2020flashsciencecovid (accessed 12 October 2020).

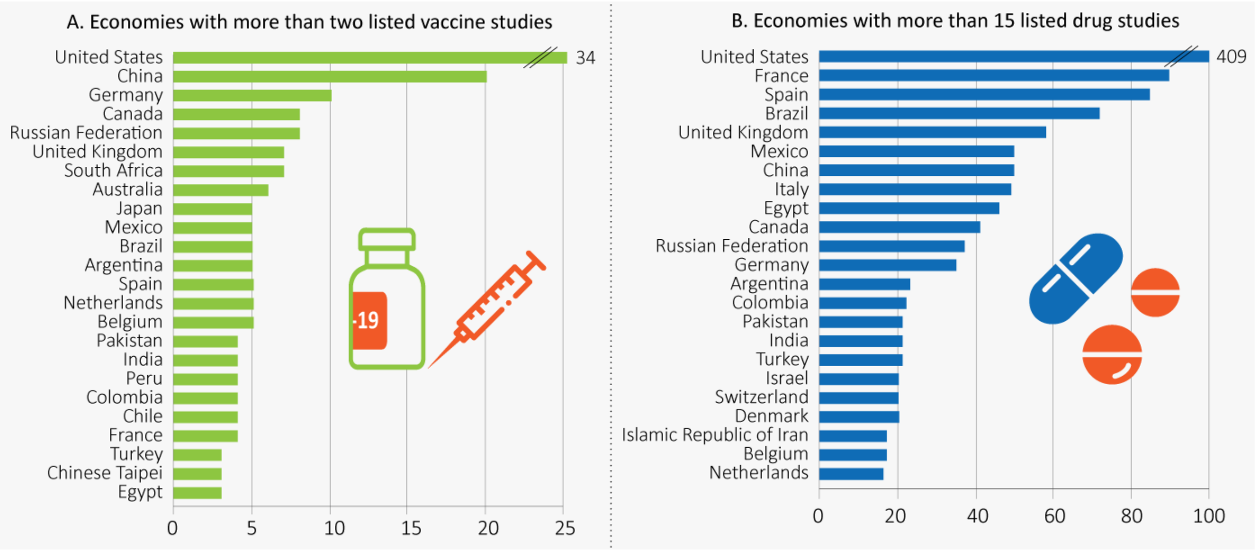
StatLink https://doi.org/10.1787/888934223118

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 emerge from it as robustly as possible. Many firms have newly deployed or expanded their use of digital technologies to maintain their operations. The biopharmaceutical industry, often in partnership with academia, has launched hundreds of clinical trials targeting COVID-19 drugs and vaccines (Figure 5). Academic start-up companies have played significant roles in these efforts.

Figure 5. Registered COVID-19 vaccine and drug studies by economy

Number of COVID-19 studies, January to December 8, 2020



Note: The charts show the number of COVID-19 studies registered at the NIH's ClinicalTrials.gov. The International Committee of Medical Journal Editors requires trial registration as a condition for publishing research results generated by a clinical trial. Multi-economy registered studies are counted in each economy. Note that the number of studies is not necessarily indicative of the breadth or depth of the studies conducted within each territory.

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

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Another phenomenon observed during the first months of the pandemic was the rapid development of "frugal innovations" in response to shortages of medical equipment and other emergency supplies. The general public has also contributed through online fora and maker spaces, where engineers and scientists have successfully redesigned ventilators and other medical equipment to permit rapid production increases from locally available components. The need for such innovation will persist as countries face challenges in ramping up the production and distribution of vaccines.

Emerging technologies have important roles to play in tackling the pandemic and its impacts

Digital and biomedical technologies are playing essential and highly visible roles in combatting the pandemic's impacts and finding medical solutions, particularly with regards to rapid vaccine development. Two emerging technologies, engineering biology and robotics, have shown promise in helping enhance the health resiliency of societies. Engineering biology attempts to turn biotechnology into a discipline more reminiscent of engineering than biology, and is more sharply focused on industrial production. A recent technological breakthrough, the biofoundry, can greatly reduce the time from idea to product, and improve the reliability and reproducibility of bio-manufacturing. Biofoundries are highly automated facilities that follow detailed, complex workflows through the co-ordinated use of laboratory robots. The messenger RNA vaccines for COVID-19 (e.g. the Pfizer-BioNTech and Moderna vaccines that have been the first to clear clinical trials) are especially amenable to this approach. Beyond their use in biofoundries, robotics can play other roles that enhance the health resiliency of societies, from aiding laboratory research, surgery and physical rehabilitation, to delivering medicines, transporting waste, combating loneliness and improving medical diagnostics and treatments. Governments possess several tools – including support to R&D and public-private partnerships – to accelerate the development and deployment of such technologies.

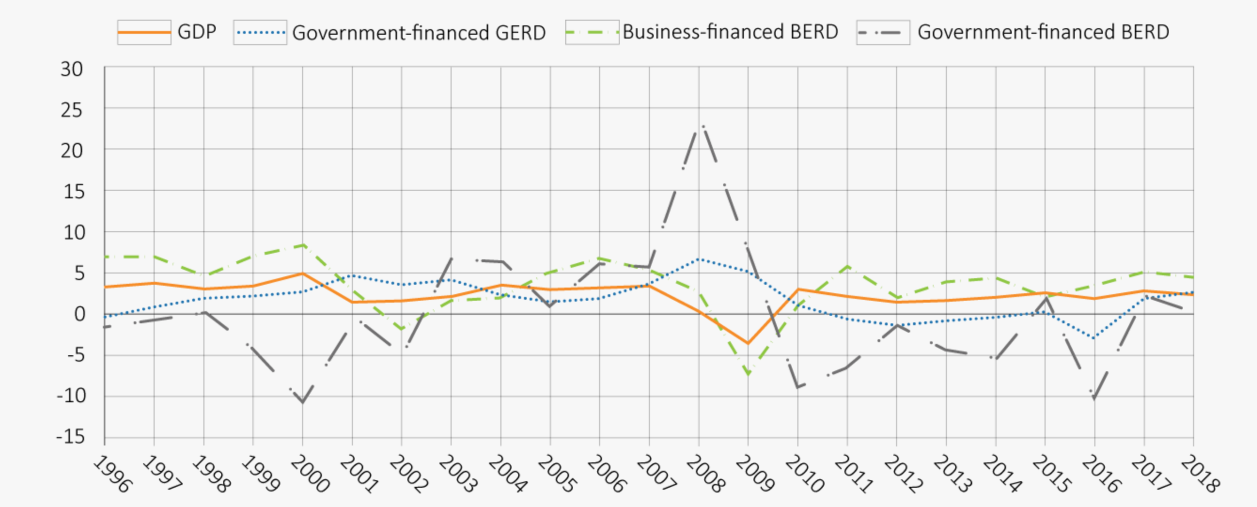
Business research and innovation have been affected unevenly by the crisis

The COVID-19 crisis has disrupted the normal functioning of innovation systems. On an aggregate basis, business investments in research and innovation are pro-cyclical, and thus prone to contracting in times of crisis (Figure 6). This crisis may be different, however, since some of the companies that spend most on R&D appear to be expanding their R&D activities during the crisis.

Some businesses, particularly in the digital and pharmaceutical sectors, have thrived during the pandemic, raising their R&D investments, while major companies in other sectors – including automotive, aerospace and defence – have reduced their R&D spending (Figure 7).

Figure 6. The impact of the business cycle on business R&D and government support

OECD area, annual growth rate



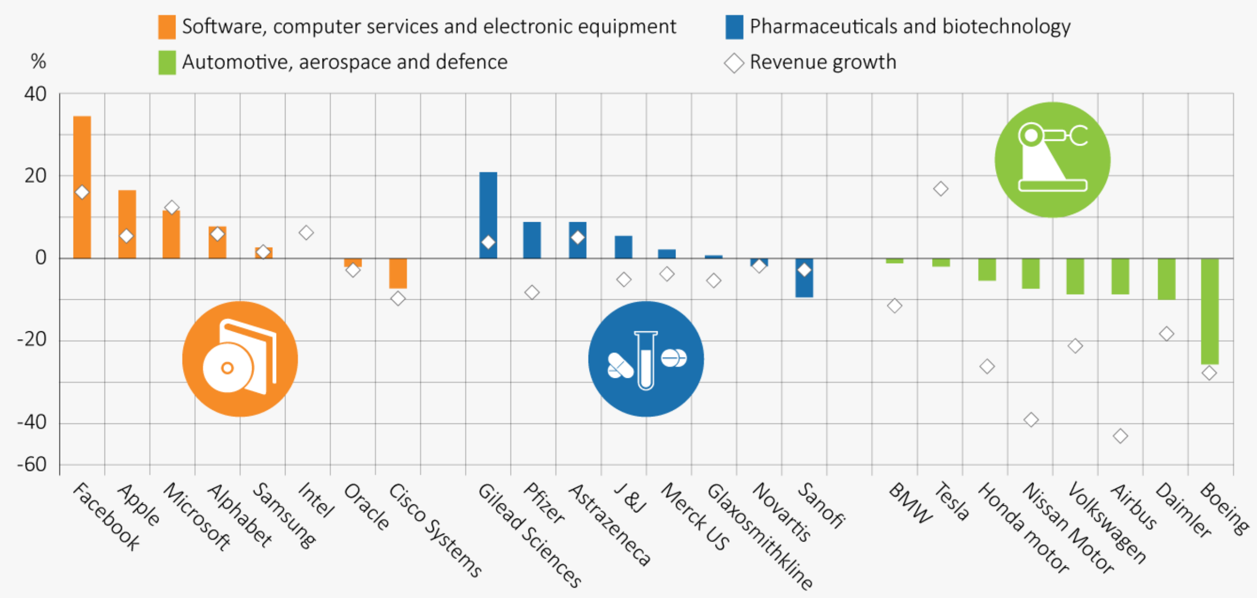
Note: The estimate of government-financed business enterprise expenditure on R&D (BERD) for 2008 reflects to some extent a break in the series for federally funded support to business in the United States. This also applies to a less visible extent to the estimate of government-financed gross domestic expenditure on R&D (GERD).

Source: OECD Main Science and Technology Indicators (database), http://oe.cd/msti (accessed October 2020).

StatLink https://doi.org/10.1787/888934223460

Figure 7. Reported R&D expense and revenue growth in selected R&D companies

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



Note: R&D growth rates are in nominal terms and measured between April to September 2019 and April to September 2020. Data refer to the 6-month period from the beginning of April to the end of September, except for Cisco (May to October) and Oracle (March to August). Company reports of R&D expense need not coincide with R&D expenditures as covered in official R&D statistics compiled according to the Frascati Manual. Methodological information can be found in the StatLinks below.

Source: OECD calculations, based on published quarterly business financial reports, December 2020.

StatLink https://doi.org/10.1787/888934223156

The crisis has also accelerated the use of digital technologies to facilitate telework, e-learning, e-commerce and other activities. This has enabled parts of the economy and society to continue working, thereby mitigating the pandemic's impact. The extent to which such applications permanently change behaviours is uncertain, but there are strong indications of a lasting shift that will drive and co-evolve with advances in digital innovation. However, the crisis could exacerbate existing gaps in the uptake and use of digital technologies – between large firms and small and medium sized enterprises (SMEs), in particular, but also between sectors. If not addressed, such uneven diffusion may have important implications for firms' productivity performance as the pandemic continues to accelerate digitalisation. It could widen the productivity gap between digital adopters and digital laggards, deepen the vulnerability of laggards, and reduce economic resilience. Greater policy efforts will therefore be needed to boost the adoption and diffusion of digital tools, in particular for SMEs.

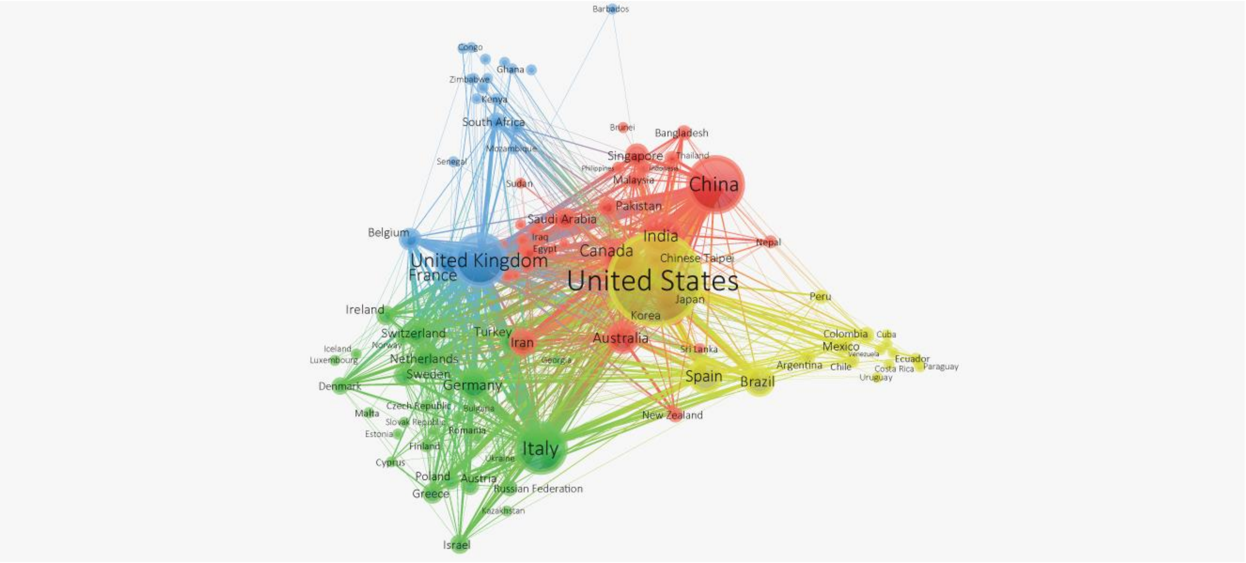
Much of the research and innovation response to COVID-19 has been international

The science and innovation response to COVID-19 has been a mix of national and international efforts. By August 2020, about USD 2 billion (a mix of public and private money) had been pledged for international research efforts (Figure 1), mostly through the Coalition for Epidemic Preparedness Innovation (CEPI) and the Global Alliance for Vaccines and Immunization (GAVI) for developing COVID-19 vaccines. These efforts have built on recent and previously untested technological and institutional innovations at the global level that have enabled the rapid development of vaccines.

The United States and China are among the two major contributors to COVID-19 publications (Figure 8), and about a quarter of their publications are co-authored with researchers based in another country. Other countries with high engagement in international research collaborations on COVID-19 include the United Kingdom, Germany, France, Italy, Australia, Canada and India.

Figure 8. International scientific collaboration on COVID-19 biomedical research

Whole counts, January to November 30, 2020



Note: A map with four clusters, also known as communities, was created based on the economy affiliation bibliographic data. Economies are assigned to clusters based on their interconnection. The colour of an item is determined by the cluster to which the item belongs. The higher the weight of an item, the larger the label and the circle of the item. Lines between items represent links. In general, the closer two economies are located to each other, the stronger their relatedness. The strongest co-authorship links between economies are also represented by lines. Note that the territory attribution for these indicators is entirely based on country affiliation information reported by the authors and publishers as registered on PubMed. More methodological information can be found in the StatLink below.

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).

StatLink https://doi.org/10.1787/888934223099

Looking forward, STI policies should be reoriented to tackle the challenges of sustainability, inclusivity and resiliency

The world is still in the midst of the COVID-19 crisis and many uncertainties remain. In the short-term, governments should continue their support for science and innovation activities that aim to develop solutions to the pandemic and mitigate its negative impacts, while paying attention to its uneven distributional effects. Science for policy will remain in the spotlight as governments seek to strike the right balance in their responses to COVID-19. This will affect public perceptions of science that could have long-term implications for science-society relations.

At the same time, many governments view the pandemic as a stark reminder of the need to transition to more sustainable, equitable and resilient societies. This is highlighted in many countries' recovery packages, which include expenditures for R&D. Science and innovation will be essential to promote and deliver such transitions, but the pandemic has exposed limits in research and innovation systems that, if not addressed, will prevent this potential from being realised.

There is therefore a need to rethink STI policies. Governments should be better equipped with the instruments and capabilities they need to orient science and innovation efforts towards the goals of sustainability, inclusivity and resiliency (Figure 9). Research systems will need to be reformed to promote the transdisciplinary approaches needed to deal with complex, multifaceted problems. Improving the ability of societies to react to crises like COVID-19 will also require the reform of PhD and post-doctoral training to support a diversity of career paths.

The global nature of many societal challenges suggests that solutions will require international co-operation. The momentum created by the pandemic offers opportunities to establish effective and sustainable global mechanisms to support the range and scope of R&D necessary to confront a wider range of global challenges. Many key uncertainties will remain over the next few months and years, and governments will need to develop dynamic capabilities to adapt and learn in the face of rapidly changing conditions.

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

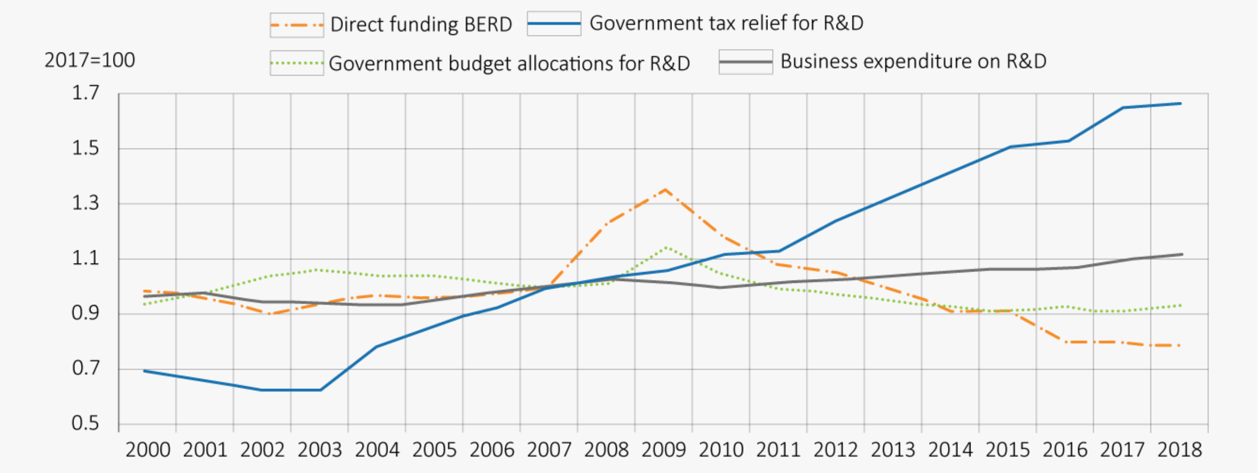
The STI policy mix needs to be more targeted

The current crisis serves as a reminder that policy needs to guide innovation efforts to where they are most needed. Governments need to build innovation support portfolios that equip them with mechanisms, instruments and capabilities to direct innovation efforts, especially for tackling pressing societal challenges.

Given that firms carry out close to 70% of R&D in the OECD area, recovery packages will need to include a mix of measures that direct private-sector innovation efforts towards sustainability and resiliency goals, especially in cases where market signals prove insufficient and co-ordination is challenging. Policy measures should reduce uncertainties by signalling intended public sector investments and future demand commitments.

Figure 10. Shift in business R&D support policy mix, 2000-18

Government funding of R&D in the OECD area, indexed values for key figures normalised by GDP, 2007=1



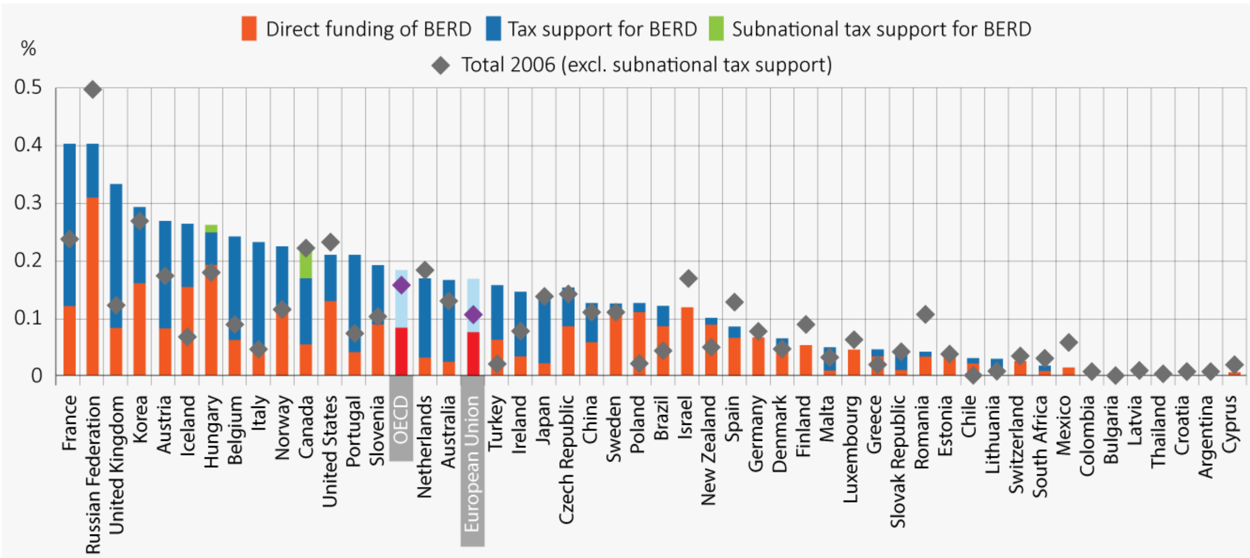
Note: For general and country-specific notes on the estimates of government tax relief for R&D expenditures (GTARD), see http://www.oecd.org/sti/rd-tax-stats-gtard-ts-notes.pdf. This chart displays figures for 37 OECD countries with the exception of GTARD figures which exclude Israel where relevant data are not available. Direct support estimates include government R&D grants and public procurement of R&D services, but exclude loans and other financial instruments that are expected to be repaid in full.
Source: OECD R&D Tax Incentives Database, http://oe.cd/rdtax, November 2020.

StatLink https://doi.org/10.1787/888934223403

With the increasing proliferation and generosity of R&D tax incentives across OECD countries and partner economies over the last decades (Figure 10), the business R&D support policy mix has shifted towards a greater reliance on tax compared to direct support instruments (such as contracts, grants or awards). Across OECD countries, tax support represented around 56% of total government support in 2018, compared to 36% in 2006 (Figure 11). While effective for incentivising businesses to innovate, R&D tax incentives are indirect and untargeted, and tend to generate incremental innovations. Well-designed direct measures for R&D are potentially better suited to supporting longer-term, high-risk research, and to targeting innovations that either generate public goods (e.g. in health) or have a high potential for knowledge spillovers. Governments should also link support for emerging technologies to broader public policy missions that encapsulate responsible innovation principles.

Figure 11. Direct government funding and government tax support for business R&D, 2018

As a percentage of GDP



Note: For general and country-specific notes on the estimates of government tax relief for R&D expenditures (GTARD), see http://www.oecd.org/sti/rd-tax-stats-gtard-ts-notes.pdf. Estimates of total OECD direct funding of BERD cover 37 OECD countries, estimates of total OECD R&D tax support (central government level) cover 36 OECD countries, excluding Israel, where R&D tax relief estimates are not available. Direct support figures refer only to intramural R&D expenditures, except for Brazil. Estimates of total OECD (EU) direct funding of BERD cover 37 OECD (27 EU) countries, whereas estimates of total OECD (EU) R&D tax support (central government level) cover 36 OECD (26) countries, excluding Israel (Croatia), where R&D tax relief estimates are not available. EU government-financed BERD in 2018 based on OECD estimate.
Source: OECD R&D Tax Incentives Database, http://oe.cd/rdtax, December 2020.

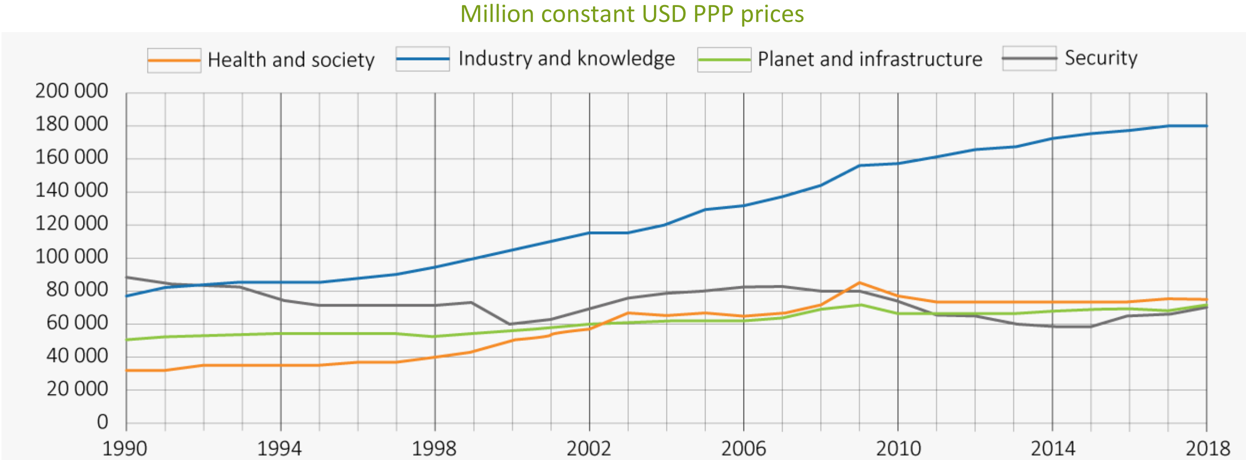
StatLink https://doi.org/10.1787/888934223422

Government R&D expenditures may need to shift to reflect new priorities

As shown by a tentative, experimental mapping of government R&D support onto four Sustainable Development Goal (SDG) clusters over the last three decades (Figure 12), support for industry and knowledge has been the fastest growing SDG-related cluster category, partly due to the growing popularity of R&D tax incentives. Funding for health and society reached a peak in 2009, while there has been limited growth in support for R&D on planet and infrastructure SDGs. If health and the environment are increasingly prioritised in the wake of the pandemic, and growing attention is given to the climate emergency, these trends could change sharply in the coming years, especially if R&D tax incentives play a less prominent role in future policy mixes.

Figure 12. Estimates of total government support for R&D by SDG-related cluster categories, 1990-2018

Million constant USD PPP prices



Source: OECD (2020). "OECD Main Science and Technology Indicators. R&D Highlights in the February 2020 Publication", Directorate for Science, Technology and Innovation. www.oecd.org/sti/msti2020.pdf.

Growing government debt could lead to austerity, and some hard choices for research and innovation policy

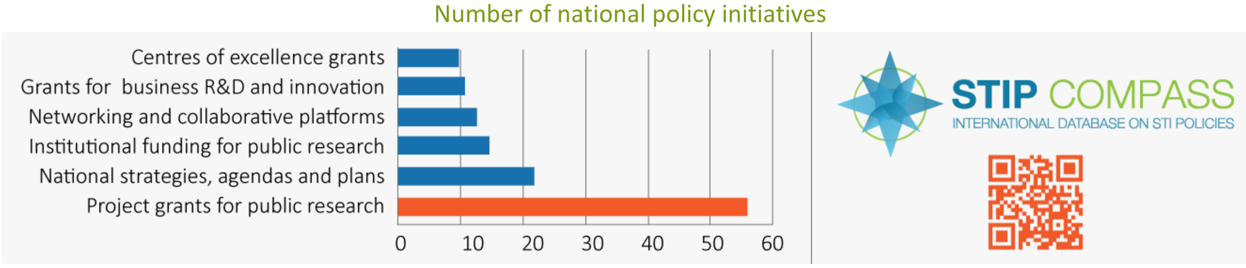
Ensuring the affordability of government intervention will be a major concern for many countries as the economic costs of the pandemic rise. Government debt in all countries is unprecedentedly high, far above the levels reached during the global financial crisis. Such unfavourable conditions could severely restrict the scope and scale of STI policy, as happened in the period following the global financial crisis (Figure 6). Budget constraints will also leave policymakers with hard choices about what to prioritise in their support for research and innovation. More resources are likely to be directed towards health research and innovation in the wake of the pandemic, but if the total amount of funding remains unchanged or even decreases, this implies a decline of public resources for other research and innovation areas.

Transdisciplinary approaches are needed to deal with complex, multifaceted problems

Reforms are required to tackle incentive structures in science that discourage high-risk and interdisciplinary research, inhibit data sharing, and reduce career mobility. The complex, multifaceted nature of addressing problems like COVID-19 and sustainability transitions underscores the need for transdisciplinary approaches to which current research system norms and institutions are ill-adapted. The disciplinary and hierarchical structures that have served science so well until now need to be adjusted to enable and promote transdisciplinary research that engages different disciplines and sectors to address complex challenges. Governments have roles to play in promoting this adjustment through a mix of policy initiatives (Figure 13).

Figure 13. Most common policy instruments used by national governments to promote interdisciplinary research

Number of national policy initiatives



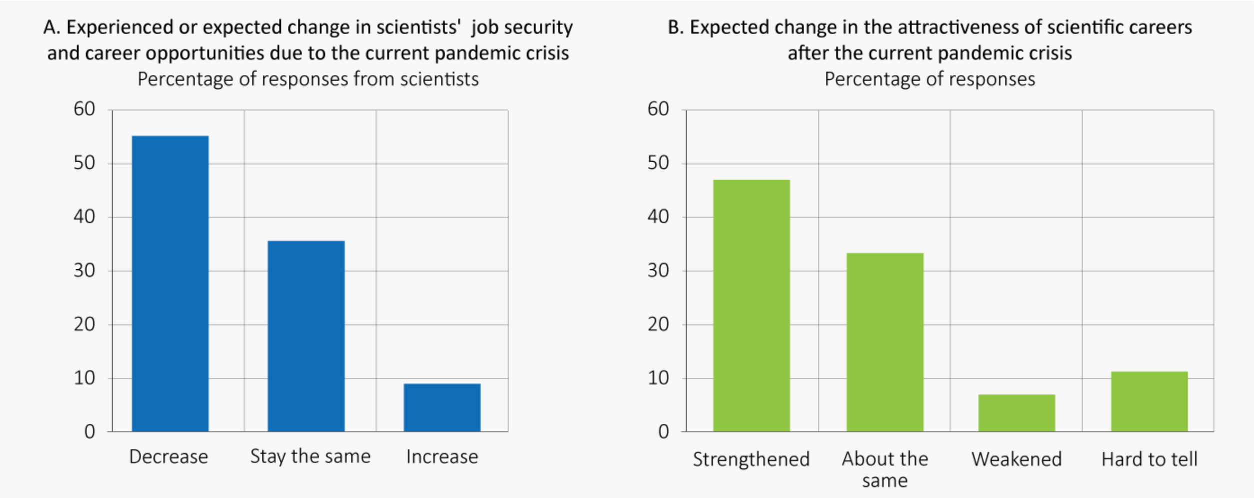
Source: EC/OECD (2020), STIP Compass: International Database on Science, Technology and Innovation Policy (STIP), edition 15 November 2020, https://stip.oecd.org.

Postgraduate training regimes need reforming to support a diversity of career paths

The crisis has shown that the need for STI expertise is not limited to the public laboratory; it is also important for business, government and NGOs, and contributes to societies' resilience. Reforming PhD and post-doctoral training to support a diversity of career paths is essential for improving societies' ability to react to crises like COVID-19, and to deal with long-term challenges like climate change that demand science-based responses. Reforms could also help relieve the precarity of early-career researchers, many of whom are employed on short-term contracts with no clear prospect of a permanent academic position. There has been a 25% increase in the number of people with PhDs in OECD countries over the past decade with no corresponding increase in academic posts. The pandemic is expected to make matters worse: 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 (Figure 14).

New and more attractive career paths are required to provide greater security and alternative options for mobility in and out of academia and other research sectors. New incentives and measures for evaluating both individual and collective contributions to science need to be implemented to support these alternative career options. The crisis has also highlighted the importance of data-intensive science. A new cohort of digitally skilled research support professionals and scientists needs to be trained and embraced in academia.

Figure 14. Scientists' expectations for a research career in light of the COVID-19 crisis



Note: Panel A shows the percentage of responses by scientists to the question, "As a result of the current crisis, have you personally experienced or do you expect to experience a change in your job security and career opportunities?" Panel B shows the percentage of all responses to the question, "How do you expect the world of science to emerge out of the current crisis, in terms of attractiveness of scientific careers?".
Source: OECD Science Flash Survey 2020, https://oecdsciencesurveys.github.io/2020flashsciencecovid (accessed 1 October 2020).

StatLink https://doi.org/10.1787/888934223498

Global challenges require global solutions

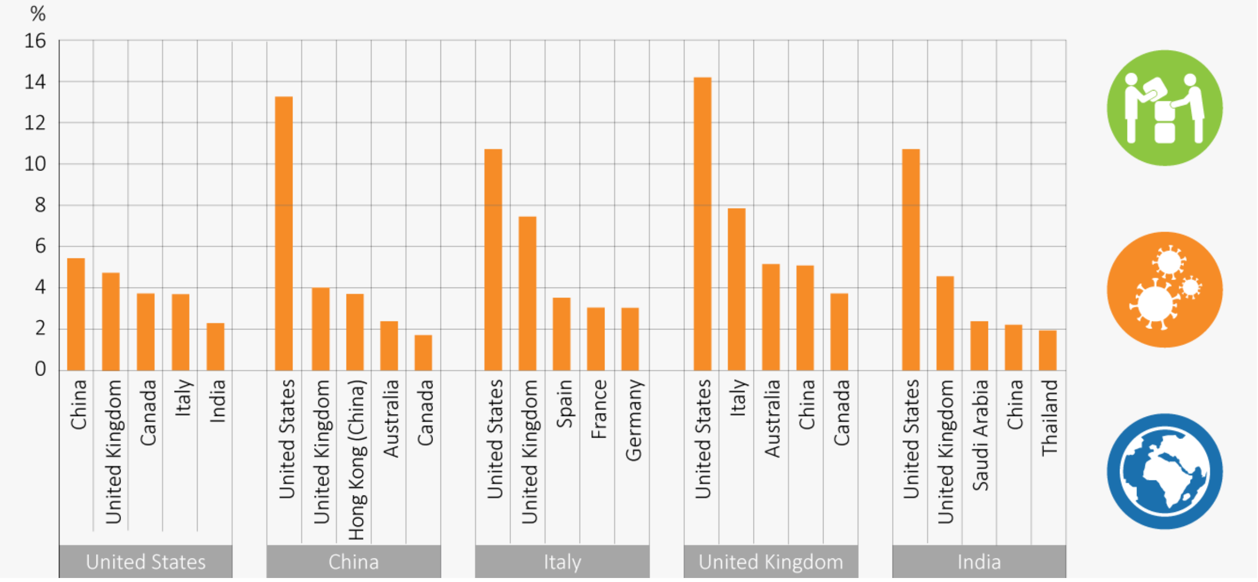
As the pandemic is a global problem, it requires global solutions involving international co-operation and collaboration. No single country can beat COVID-19 on its own. The speed with which research groups and biopharmaceutical firms are developing COVID-19 vaccines builds on years of basic research investment, as well as the recent institutionalisation of international co-ordination efforts to develop agile technology platforms that can be activated as new pathogens emerge. These relatively new arrangements are performing well, but remain underfunded and dependent on a handful of countries and philanthropic institutions for financing. Governments should consider scaling them up and extending them to other global challenges where R&D preparedness is important, capitalising on the momentum from the response to COVID-19. R&D preparedness measures include technology platforms, infrastructures and collaborative networks that will improve countries' abilities to respond effectively to a diverse range of risks.

Governments also need to work together on new financing and governance mechanisms, wherein business and private-finance actors work with multilateral and national development banks to co-finance STI solutions for global challenges. The rapid and unprecedented mobilisation of public and private R&D funding for COVID-19 vaccines and their global distribution demonstrates that new innovative funding models can be deployed to address global challenges through international STI co-operation.

A lot of international scientific co-operation on COVID-19 has been initiated by researchers themselves, and has built on existing ties. For example, research links between China and OECD countries have grown strongly in recent years, and this is reflected in patterns of COVID-19 co-publication (Figure 15). China has become the world's second-largest R&D performer, having 80% of the GERD of the United States in 2018 (Figure 16). But there are concerns that a lack of openness and reciprocity in some of these collaborative relationships may threaten their future. Governments need to build trust and define common values to ensure a level playing field for scientific co-operation and an equitable distribution of benefits.

Figure 15. Share of international scientific collaboration on COVID-19 medical research by partner economy

Top 5 countries and their top 5 partner countries, total number of documents (fractional counts), January-November 2020



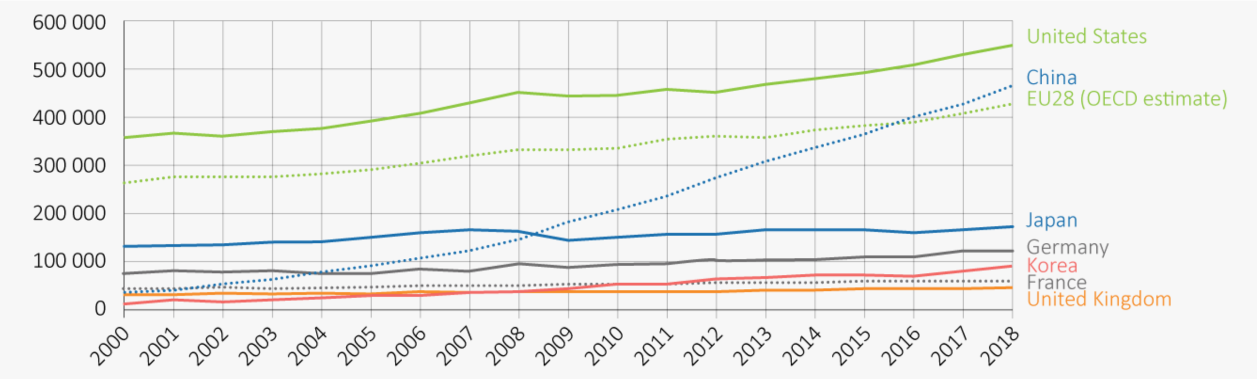
Note: The period covers 1 January to 30 November 2020 and includes 74 115 documents. The United States co-authored 16 964 documents. 84% of those were domestic co-authorships, while the remainder involved international collaboration. The top collaboration partner of the United States is China, and US-China collaboration represents 5.5% of all United States publications on COVID-19-related medical research.

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

StatLink https://doi.org/10.1787/888934223479

Figure 16. Gross Domestic Expenditure on R&D, 2000-18

Million USD PPP constant prices



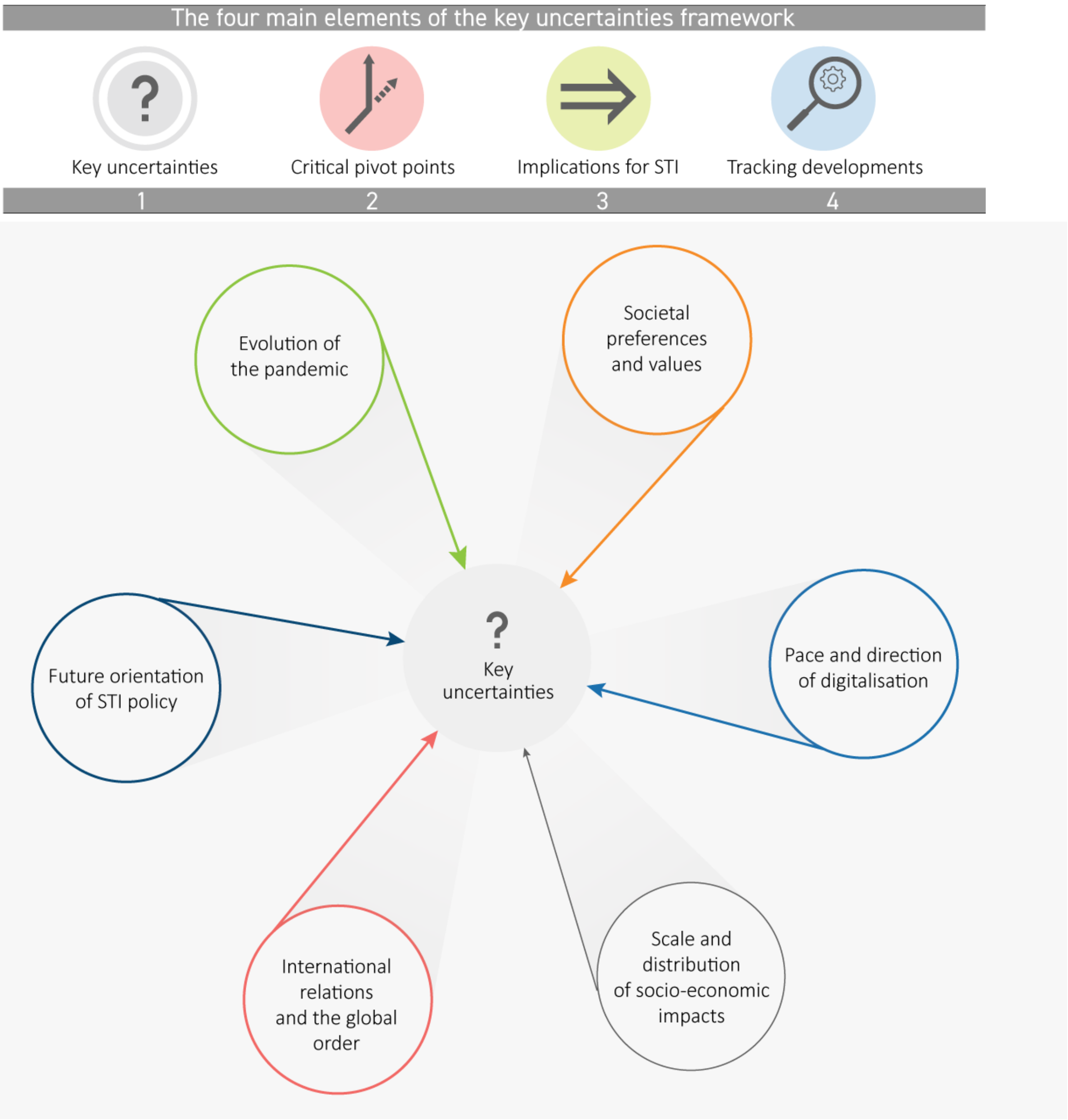
Source: OECD MSTI 2020/1 (August update), http://www.oecd.org/sti/msti.htm.

Building government capabilities to meet future challenges will be a major challenge in itself

Developing public sector capabilities to deliver more ambitious STI policy will become an increasingly significant concern. For instance, increased policy emphasis on building resilience, which calls for policy agility, highlights the need for dynamic capabilities to adapt and learn in the face of rapidly changing environments. Governments will need to prepare more effectively for future shocks, assessing developments around key uncertainties and their implications for STI. It will be important to engage stakeholders and citizens in these efforts, in order to capture a diversity of knowledge and values.

Many key uncertainties will persist over the coming months and years, shaping the threats that research and innovation systems face, and the contributions they can make to solving societies' grand challenges. Policymakers can benefit from using a structured framework to systematically monitor the evolution of the crisis and its impacts from an STI policy perspective (Figure 17). When combined with regular indicators-based monitoring, such a framework can operate as an early warning system that alerts policy makers (and others) to possible future developments. It also allows decision makers to identify alternative pathways and outcomes to pursue or avoid. Indeed, the shape of uncertainty is formed by choices, and in most cases, governments can choose to avoid some obviously bad options and to pursue more promising ones. The *OECD STI Outlook* provides evidence and analysis that aims to help policymakers when weighing their options in these times of crisis and opportunity.

Figure 17. The STI Outlook's key uncertainties framework and its use to explore the post-COVID-19 STI policy landscape



OECD Science, Technology and Innovation Outlook 2021

TIMES OF CRISIS AND OPPORTUNITY

In immediate responses to the COVID-19 crisis, science and innovation are playing essential roles in providing a better scientific understanding of the virus, as well as in the development of vaccines, treatments and diagnostics. Both the public and private sectors have poured billions of dollars into these efforts, accompanied by unprecedented levels of global cooperation. However, the economic crisis that is currently unfolding is expected to severely curtail research and innovation expenditures in firms, while debt-laden governments will face multiple, competing demands for financial support. These developments threaten to cause long-term damage to innovation systems at a time when science and innovation are most needed to deal with the climate emergency, meet the Sustainable Development Goals, and accelerate the digital transformation. Governments will need to take measures to protect their innovation systems as part of their stimulus and recovery packages, but should also use these as opportunities for reforms. In particular, science, technology and innovation (STI) policy should shift towards supporting a more ambitious agenda of system transformation that promotes a managed transition to more sustainable, equitable and resilient futures.

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