



## Policy recommendations

G7 Academies of Science urge governments to:

- i. expand investment and capabilities in science and pre-competitive technologies;
- ii. increase investment in infrastructures - both tangible and intangible - that contribute to inclusive development and to progress in science and technology;
- iii. promote the development of capacities to design, engineer, produce and deliver products and services based on new science and technology;
- iv. promote open access - subject to appropriate regulations with regard to intellectual property - to advances in science and technology, while preventing the emergence of monopolistic practices;
- v. share effective practices in policies and programs that promote innovation, technological diffusion, and efficient infrastructure development. Actions should be taken with all appropriate partners, such as Multilateral and National Development Banks, especially for reducing the North-South divide;
- vi. ensure that appropriate governance frameworks are adopted, so that the benefits of science and technology are fully realized, while maintaining public trust.

## 1. Challenges

### 1.1. Science and technology for growth and sustainability

Science, technology and innovation have long been important drivers of economic growth and human development. Growth relies on the integration of basic and applied research, at both public and private levels, on an international scale. The challenge is to ensure that, even during phases of economic slowdown, science and technology continue to support the objectives of sustainability and improved living standards in all countries.

Institutional arrangements are needed to make sure that the potential of science and technology is aligned with the paths and strategies of economic development, social inclusion and environmental sustainability, as argued by the United Nations report, "Transforming our world: the 2030 Agenda for Sustainable Development".

This year our statement highlights the importance of investing in science, technology and infrastructure, in

line with Goal 9 of the UN 2030 Agenda for Sustainable Development, which is to "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". In the aftermath of the 2008 economic crisis that has slowed down world growth, we need to make sure that investment in science, technology, innovation and infrastructure expands its contribution to sustainable and inclusive world growth.

### 1.2. Technological and innovation drivers for a new growth

Innovation has played a crucial role in the rapid growth of advanced and emerging economies; however there are increasing concerns that the benefits of technology-led economic growth have not reached all members of society. Furthermore, growth is placing increasing demands on finite natural resources and is contributing to climate change. In addition, the diffusion of new information technologies raises issues of ethics, privacy, security and trust.

Today, technological drivers with accelerating impact include:

- Digitalization and automation of production, including integration of different technological drivers in the reorganization of economic activities;
- Smart systems, especially in renewable energy, transport, mobility and human-machine interfaces;
- Artificial Intelligence, with its ability to change our work-life balance and to impact many fields such as transportation and health care;
- Bio-medical technology, with the exploitation of the new knowledge offered by genomics and its expansion to the diverse sectors of the "omics" revolution, with benefits extending even beyond health;
- Sustainable technologies that could reshape the activities of production and consumption in ways that conserve natural resources, reduce climate change and improve environmental quality.

Attention should be given to emerging technologies in light of their potential to impact virtually all economic activities:

- Nano, Bio and Quantum technologies, yielding the ability to control matter (from inorganic to living) at the atomic level with boundless range of applications in industry, health and infrastructure;



- Data Science, thanks to the ability to extract new knowledge and policy capability by the integrated algorithmic analysis of highly diverse data generated today at exponentially growing pace.

These and presumably other yet-to-emerge scientific advances in materials, information and other fields have a disruptive potential, and deserve attention in terms not only of private and public investment but also of novel public policies that ensure that the benefits of science and technology are fully realized while moving toward global sustainability, inclusion and social responsibility.

## 2. Strategies and public policies

### 2.1. Investing in science and technology

Growing levels of public and private investments in science and technology are needed to address the challenges of sustainable and inclusive growth. R&D expenditure as a share of GDP has increased in few countries but has stagnated or declined in many advanced and emerging economies. This is in contrast to the policy objectives of many countries such as the European Union's "Europe 2020" goal of spending 3% of GDP on R&D.

Current gaps in R&D efforts make it more difficult to access, adopt and expand knowledge and innovation, limiting the realization of their benefits. Public policies should recognize the key role that expenditure for fundamental research, for the advancement and diffusion of knowledge, culture, higher education and innovation can play in supporting high quality socio-economic growth, and that these benefits outweigh many short-term concerns for balancing public finances.

In recent years, many corporations have limited investment in research and technology - which requires long investment horizons - and have favored short-term returns from financial assets, thus presenting a further threat to economic growth. Well-designed public policies could encourage business investment with longer time horizons, supporting also high-risk projects. In some instances, public-private partnerships and fiscal incentives could encourage shared investments by firms in precompetitive research in science and technology.

Several arrangements for securing finance - from both public and private sources - are necessary to ensure that G7 economies meet the requirements of the UN Sustainable Development Goals. These funds should support environmentally sustainable infrastructure and investment, and develop products, processes and organizations that use less energy, land and natural resources, have a lower climate impact, move towards renewable energy sources and sustainable transport systems, consider the repair and maintenance of existing goods and infrastructure, and protect nature's ecosystems.

### 2.2. Investing in infrastructure

The provision of tangible and intangible infrastructure is a pre-requisite for inclusive and sustainable growth, and an important case of the need for public action. New technology-based growth requires new classes of infrastructure: digital connectivity, broadband communication networks, smart renewable energy grids, sustainable transport systems require the development of new or renovated infrastructure. In parallel there is a need for stronger networks for cooperation in research, knowledge generation, technology transfer, innovation diffusion, human resource development, education, re-training and skills, raising public awareness and dialogue on science and technology.

As a consequence of the recent economic slowdown, most countries have reduced their infrastructure spending and public investment, despite the availability of low-cost finance. A new growth of investment is now needed, as stressed, for instance, by the OECD and the G20 Summits held in Turkey (2015) and in China (2016).

Several studies have documented the extremely large gap between current infrastructure investment and that needed to achieve the UN Sustainable Development Goals. Innovative solutions, again with important contributions by new technologies, have the potential to allow such infrastructure to be provided and managed at lower cost. This lack of investment also prolongs the current period of slow world growth.

### 2.3. Innovation diffusion: matching institutions and markets

If innovation is to advance shared growth and sustainability, a number of conditions need to be met. On the supply side, there is a need for adequate long-term public funding of research and development in order to expand knowledge as a public good. There is also a need for adequate demand - from the private and public sectors - for the goods and services that are associated with the spread of new technologies. Governments can play an important role in stimulating new demand through targeted public research programs, procurement for public services, and public investment in infrastructure.

Appropriate institutions, rules and frameworks for the emergence of new technology-based economic initiatives, markets and social activities need to be in place. Examples include common standards, global platforms and digital networks. The development of these and other activities should also be based on shared ethical values, privacy protection and security, and rules ensuring access and the prevention of the emergence of monopolistic practices. Appropriate institutional arrangements at the international level are needed to address these challenges.



#### 2.4. Reducing the North-South divide

There is evidence of divergence in science and technology activities and infrastructure investment among and within G7 and G20 countries, as well as between North and South. All countries - including emerging economies - should be encouraged and supported in their need to devote more resources to research, education and innovation.

Moreover, the success of some emerging economies has demonstrated the value of diffusing science, technology and education. However, the North-South divide is still large, especially in science and technology, and new divides may be emerging - in digital technology, access to knowledge, environmental conditions and health. International arrangements for ensuring the openness of the science system and mutually favourable technology flows among all countries are an important condition for renewed progress.

Multilateral and National Development/Promotional Banks must play a larger role in addressing such challenges, as they combine government legitimacy, a policy mission and their own direct operations in global financial markets. They can mobilise large private financial resources, ensure appropriate investment choices, and manage and monitor the implementation of innovative infrastructure projects.

#### 3. The role of G7 Academies

The Academies of Sciences of G7 countries have an important responsibility in identifying challenges for research and in promoting efficient institutional fra-

meworks to deliver technological solutions for sustainable and inclusive growth. We reaffirm that science is an international endeavor and a collaborative enterprise. The role of Academies as guardians of the values of free inquiry and of the paramount importance of scientific evidence is more critical than ever.

In advising governments on policy, the Academies should take a holistic approach to the problems of sustainable development that enables interdisciplinary research involving the natural, social and human sciences. The Academies are also committed to provide open fora where important developments in science and technology are discussed, with specific attention to their interconnections.

In order to fulfill these tasks, Academies are committed to collaborate - both directly and in international associations - in addressing problems with a major international dimension, in searching for common solutions and in evaluating implications of policy options.

#### 4. Recommendations to G7 Governments

With this statement G7 Academies of Science call on G7 governments to take action for the implementation of the UN 2030 Agenda for Sustainable Development, with particular attention to Goal 9 on innovation and infrastructure. Investment in science, technology, innovation and infrastructure is an essential driver for sustainable and inclusive world growth. To this end, G7 Academies urge their governments to act on the policy recommendations listed above.

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