

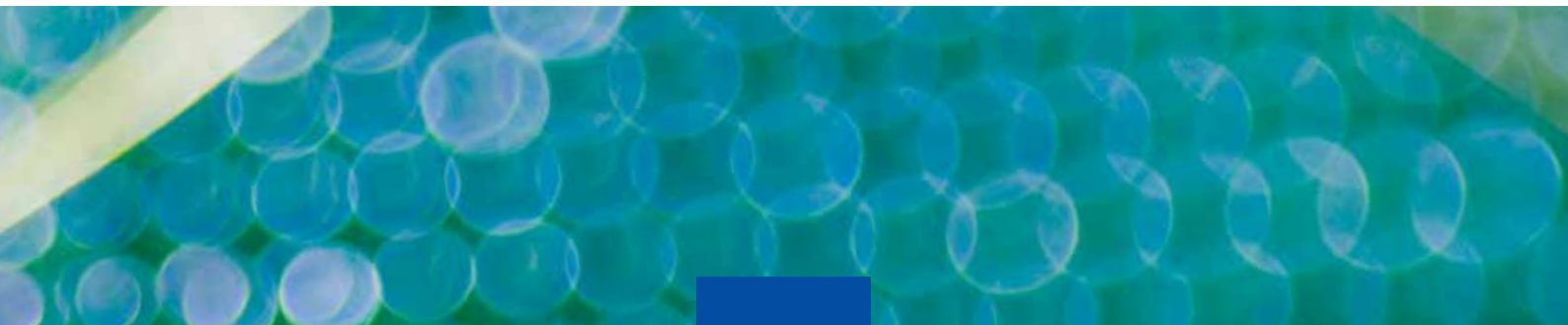


THE EUROPEAN
UNION
EXPLAINED

Research and Innovation

Pushing
boundaries and
improving the
quality of life

Research and innovation contribute directly to prosperity in Europe and the well-being of its citizens and society.



THE EUROPEAN UNION EXPLAINED

This publication is a part of a series that explains what the EU does in different policy areas, why the EU is involved and what the results are.

You can find the publications online:

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The European Union explained: Research and Innovation

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1049 Brussels
BELGIUM

Manuscript updated in November 2014

Cover and page 2 picture:
© Glowimages RF/F1online

12 pp. — 21 × 29.7 cm
ISBN 978-92-79-42384-0
doi:10.2775/74012

Luxembourg: Publications Office
of the European Union, 2014

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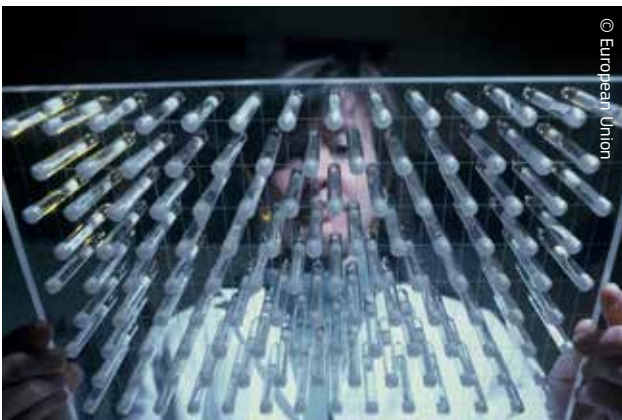
Why we need a European research and innovation policy

Research and innovation contribute to making Europe a better place in which to live and work. They improve Europe's competitiveness, boost growth and create jobs. At the same time, research and innovation help make people's lives better by improving healthcare, transport, digital services and countless new products and services.

The European Union (EU) is a major player in international science and technology, and a clear leader in many areas such as renewable energy and environmental protection.

Europe's future is connected to its power to innovate: to turn great ideas into products and services that will bring growth to our economy and create jobs. The innovation union initiative, the EU's strategy to promote this process, will provide an environment in which Europe can foster new ideas. The innovation union is part of the Europe 2020 strategy, the EU's growth strategy, that stipulates an investment of 3 % of gross domestic product (GDP) in research and innovation, across the public and private sectors combined, by 2020.

Investing in research and technology creates a better society for citizens.



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The EU is the main knowledge factory in the world. It accounts for almost a third of global science and technology production. Despite the economic crisis of the past few years, the EU and its Member States have managed to maintain this competitive knowledge position.

However, the EU is facing increased global competition in research and technology production, and within Europe we need to make sure our innovative ideas turn into successful new products and technologies. All Member States have their own research policies and funding schemes, but there are many key issues that can be best tackled by working together — which is why research and innovation is also funded at the EU level.

Horizon 2020, the EU's new research framework programme, will strengthen Europe's innovation leadership by fostering excellence in research and the development of innovative technologies. Almost €80 billion will be invested in the period 2014–20 in research and innovation projects. This will help the EU produce new products and services that are competitive for the international market.

But this is not all. By 2050, the world population may reach 9 billion people, with two fifths over 50 years old. Three quarters of the global population will live in cities, and over 60 % will live in small households — alone or with just one other person. These profound demographic changes will take place in the course of just a few decades. This is why a substantial part of Horizon 2020 is also dedicated towards finding responses to issues such as stable energy supplies, global warming, public health, security of water and food resources. Investing in research and technology is the only way to support resource efficiency and diversity, protect the environment and combat poverty and social exclusion — in short, to create a better society for citizens.

If Europe is to find solutions to societal challenges while boosting growth and competitiveness, it also needs a fully functioning network of research excellence. The same research should not be funded 28 times from the public purse across Europe; this should be done only once at the most appropriate research centre and the results should be shared. Given the demand for excellent researchers it should be easier for them to move across Europe than cross

the Atlantic. We need open and transparent recruitment and gender equality in research. The EU needs a single market for ideas to help researchers, their knowledge and results to circulate and be used freely across Europe. This is why EU Member States have agreed to work together to knock down barriers and create a European research area, that together with Horizon 2020 will help ensure that every euro spent on research will have the greatest impact.

A brief history of EU research policy

1950s: Provisions for research are included in the European Coal and Steel Community (ECSC, 1951) and European Atomic Energy Community (Euratom, 1957) treaties.

1957: The treaty setting up the European Economic Community (the EEC or 'common market') leads to a number of research programmes in areas considered priorities at the time, such as energy, the environment and biotechnology.

1983: The European strategic programme on research in information technology (Esprit) launches a series of integrated programmes in information technology research, as well as development projects and industrial technology transfer measures.

1984: The first 'framework programme (FP)' for research is launched. These programmes will become the EU's main funding instrument for research. FP1 focuses on research in biotechnology, telecommunications and industrial technology.

1986: Research becomes a formal Community policy, with a specific chapter in the Single European Act. The objective is to 'strengthen the scientific and technological basis of European industry and to encourage it to become more competitive at international level'.

2000: The EU agrees to work towards a European research area (ERA): a unified research area open to the world and based on the internal market, in which researchers, scientific knowledge and technology can circulate freely.

2007: The European Research Council (ERC) is created as part of the seventh framework programme (FP7). Its mission is the support of frontier research across all fields, on the basis of scientific excellence.

2008: The Budapest-based European Institute of Innovation and Technology is created: the first EU initiative to fully integrate all three sides of the 'knowledge triangle' (higher education, research and business) through support for knowledge and innovation communities. It becomes operational in 2010.

2010: The EU launches the innovation union, an initiative consisting of more than 30 action points aimed at improving conditions and access to finance for research and innovation in Europe. The innovation union is placed at the heart of the Europe 2020 strategy to ensure that innovative ideas can be turned into products and services creating growth and jobs.

2014: Horizon 2020, the biggest EU research and innovation framework programme ever, is launched. A major financial instrument for implementing the innovation union, it will run from 2014 to 2020 with a budget of almost €80 billion. Horizon 2020 is part of the drive to create new growth and jobs in Europe.

How does the EU support research and innovation?

Since 1984, the European Union has run its research and innovation policy and funding on the basis of multiannual framework programmes. Seven framework programmes (FP1–FP7) have run between 1984 and 2013. Horizon 2020, the new EU research and innovation programme, was launched at the start of 2014.

Horizon 2020: the EU framework programme for research and innovation, delivering excellent science

Horizon 2020 is the biggest EU research and innovation programme ever. It will lead to more breakthroughs, discoveries and world firsts by taking great ideas from the lab to the market. Almost €80 billion of funding is available over 7 years (2014 to 2020), most of it in three pillars: excellent science, industrial leadership and tackling societal challenges. In addition, this investment will attract private and national public investment.

Horizon 2020 was approved by EU Member State governments and the European Parliament. They agreed that investment in research and innovation is essential for Europe's future and so put it at the heart of the Europe 2020 strategy. The goal is to ensure Europe produces world-class science and technology that drives economic growth.

In previous programmes, EU research funding brought together scientists and industry both within Europe and from around the world to find solutions to a broad range of challenges. Their innovations have improved lives, helped protect the environment and made European industry more sustainable and competitive. Horizon 2020 is open to participation from researchers from all over the world.

How Horizon 2020 helps EU researchers and industry

Continued investment in excellence-driven frontier research is essential. It is often the foundation for innovation and technological advancement, planting the seeds from which new industries and markets grow.

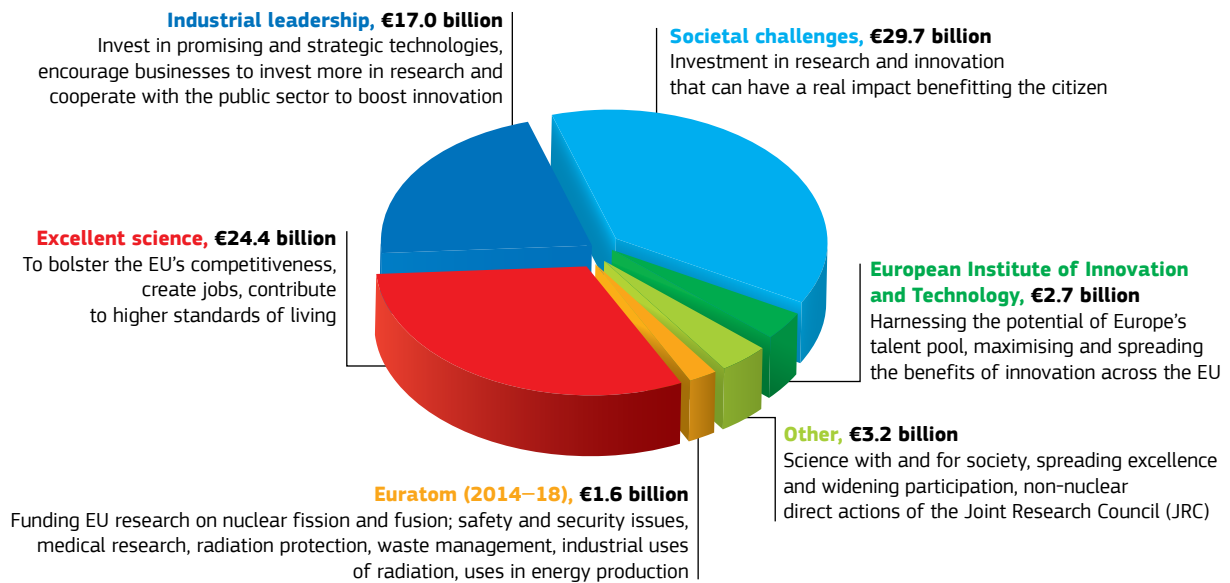
The frontier research supported by the **European Research Council** is selected solely on the basis of excellence. But when the research leads to unanticipated technology breakthroughs, Horizon 2020 also provides the means to take discoveries through to the next stages of development.

Training and career development helps produce leading researchers. Support is offered to young and experienced researchers to reinforce their career and skills through training or periods of placement in another country or in the private sector.

Training and career development helps produce leading researchers.



HORIZON 2020 BUDGET



Marie Skłodowska-Curie actions provide them with opportunities to gain new knowledge and experience, allowing them to reach their full potential.

The economic crisis has highlighted both the central role played by the EU's industrial base and the need to rejuvenate it. But market failures can prevent the private sector from raising the financial and knowledge resources needed for the modernisation of our industrial base.

Restoring growth and prosperity in Europe requires a stronger focus on industrial competitiveness based on advanced technological products and processes across the global value chain. Horizon 2020 is the most business-friendly EU research and innovation programme to date. It has a series of dedicated support measures addressing both industry in general and small and medium-sized enterprises (SMEs) in particular, including helping with access to finance.

The EU needs to develop new sources of economic growth based on advanced manufacturing supported by a modern and dynamic business environment. In some strategically important areas the private sector is not able to bring about this transformation alone because it needs access to state-of-the-art research to develop game-changing technologies. Horizon 2020 contains an **innovation investment package**, anchored around investment in strong public-private partnerships in areas such as pharmaceuticals, aeronautics and bio-based industries.

Other partnerships and research into key enabling technologies will support European industry in developing the necessary knowledge and skills base.

The support for **future and emerging technologies** will enable researchers to convert results from basic scientific research into new technologies which can then be picked up by industry and high-tech SMEs to maintain global competitiveness. Horizon 2020 will also help create world-class **research infrastructures** that are accessible to all researchers in Europe to fully exploit their potential for scientific advancement and innovation.

What Horizon 2020 will do for the citizen

Effective cooperation between **science and society** is needed to recruit new talent for science and to marry scientific excellence with social awareness and responsibility. This means understanding the issues from all sides. Horizon 2020, therefore, supports projects that involve citizens in defining the nature of the research that affects their everyday lives. A broader understanding between the specialist and non-specialist communities on objectives and the means of achieving them will maintain scientific excellence and allow society to share ownership of the results.

As a cross-cutting issue of broad relevance, **social sciences and humanities** research is fully integrated into each of the general objectives of Horizon 2020. Embedding this research across Horizon 2020 will strengthen its impact and is essential to maximise the returns to society from investment in science and technology. Integrating the socioeconomic dimension into the design, development and implementation of research itself and of new technologies can help find solutions to societal problems.

Indeed, the focus of Horizon 2020 on 'challenges' rather than disciplinary fields of research illustrates this new approach. Societal challenges, such as health, environment or transport, are important to all of us. Horizon 2020 tackles seven societal challenges, set out in the next sections, with a targeted investment in research and innovation and which have important benefits for citizens.

HEALTH AND WELL-BEING

Everyone wants a long, happy and healthy life, and scientists are doing their best to make this possible. They are tackling some of the major current health issues as well as emerging threats such as the increasing impact of Alzheimer's disease, diabetes and antibiotic-resistant 'superbugs'.

EU research and innovation is an investment in our health as it will keep older people active and independent for longer, support the development of new, safer and more effective interventions and help health and care systems to remain sustainable. It will give doctors the tools they need for more personalised medicine, and it will step up prevention and treatment of chronic and infectious diseases and help to fight antimicrobial resistance.

The return on this investment will include new ways to prevent disease, better diagnostics and more effective therapies, as well as the uptake of new models of care and new technologies promoting health and well-being. These rely on a better understanding of the fundamental nature of health and disease, and of the means to promote the former and prevent and treat the latter.

SUCCESS STORY: nanoparticles for therapy and diagnosis of Alzheimer's disease

*The EU-funded **NAD** project is developing innovative nanoparticle therapies to treat Alzheimer's disease. The team has designed nanoparticles able to cross the blood-brain barrier so that magnetic resonance imaging (MRI) or positron emission tomography (PET) scans of the brain can detect the disease. The project also confirmed the therapeutic potential of 'carrier nanoparticles', engineered to channel therapeutic substances into the brain barrier and prevent disease-causing beta-amyloid peptide aggregation.*



FOOD SECURITY AND SUSTAINABLE USE OF BIOLOGICAL RESOURCES

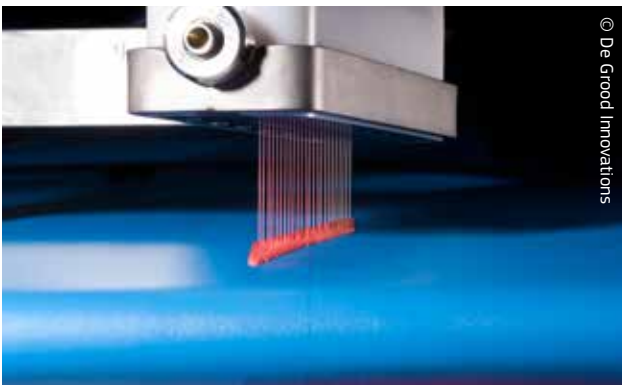
Eating well, wasting less and knowing the origin of the food you buy for yourself and your family: these are all issues of concern to European citizens. With the world population set to reach 9 billion by 2050, we need to find ways to radically change our approach to production, consumption, processing, storage, recycling and waste disposal while minimising the environmental impact.

This will include balancing the use of renewable and non-renewable resources from land, seas and oceans, transforming waste into valuable resources and the sustainable production of food, feedstuffs, bio-based products and bioenergy.

The bioeconomy holds the key to this shift towards a new, post-petroleum society encompassing sustained changes in lifestyle and resource use that cut across all levels of society and the economy. The welfare and well-being of Europe's citizens and that of future generations will depend on how these transformations are made.

SUCCESS STORY: printing meals to help people with chewing difficulties

*Faced with the prospect of only being able to eat nondescript mash, people with impaired chewing or swallowing abilities often lose their appetite and do not eat enough. This can threaten their physical health and psychological well-being. To solve this problem, the EU-funded project **Performance** seeks to provide affordable, varied meals for those affected by these impairments by printing reconstructed soft food with innovative 3D technology.*



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SUSTAINABLE ENERGY

Energy drives the modern economy, but even just maintaining our standard of living requires a huge amount of energy.

As the world's second largest economy, Europe is over-dependent on the rest of the globe for its energy — energy derived from fossil fuels that accelerate climate change. The EU has, therefore, set itself ambitious climate and energy targets.

We are consuming far more than we can afford, putting our security, competitiveness and employment in jeopardy.

It is essential for the EU to spark a new industrial revolution that will deliver a low-energy economy, while making the energy we consume to maintain our

standard of living and modern conveniences more secure, competitive, affordable and sustainable.

SUCCESS STORY: new materials for new batteries

*Lithium-ion battery technology has paved the way for the roll-out of a new generation of electrified vehicles, not to mention providing the power for a whole host of energy-hungry portable devices. Researchers are seeking new ways of improving the efficiency of the technology, and several EU projects, such as **Somabat**, are prototyping new variants showing great potential. Experts agree, however, that to go beyond 250 Wh/kg — the predicted limit for lithium-ion battery technology — new materials for the next generation post-lithium-ion batteries are needed. The new Li-air technology developed under the project **Labohr** is being assessed, and the project **ORION** is looking 5–10 years ahead at novel hybrid organic–inorganic alternatives for energy conversion and storage that could help the EU become a market leader in this area.*



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TRANSPORT

Efficient transport is a fundamental condition for sustainable wealth and prosperity in Europe. Mobility drives employment, economic growth, prosperity and global trade. It also provides vital links between people and communities. However, our transport systems and habits are not sustainable.

Our current approach is too dependent on oil, a major pollutant which in any case is rapidly running out, and transport-related problems such as congestion, road safety and atmospheric pollution impact on our daily lives and health.

The economic costs of congestion will increase by about 50 % by 2050, the accessibility gap between central and peripheral areas will widen and the social costs of accidents and noise pollution will continue to rise.

The 21st century presents us with challenges that require a collective European response.

If we do not address these challenges, people's ability to travel — and our economy — could be severely restricted and their quality of life eroded. In the transport sector, research is at the core of developing innovative technologies and ways of working that will make the changes required to maintain our mobility at low costs to society.

SUCCESS STORY: new technologies to reduce aircraft emissions and noise

*The first phase of the Clean Sky partnership has resulted in a number of breakthrough technologies that have undergone wind tunnel testing vital for further development. One of these is the **natural laminar flow wing**. This new wing has the potential to substantially reduce drag and provide up to 4 % fuel savings. Two other innovative technologies developed under Clean Sky, the **open rotor** (an innovative type of aircraft engine) and wing anti-icing and de-icing systems, also underwent successful wind tunnel testing and demonstrated a first level of maturity. This innovative type of engine design has successfully been assessed by Rolls Royce and French multinational aircraft and rocket engine manufacturer SNECMA.*



CLIMATE

The era of seemingly plentiful and cheap resources is coming to an end — there needs to be a decoupling of economic growth from resource use. The combined impacts of climate change and current production and consumption patterns are undermining our ecosystems and biodiversity.

The solution is to invest in innovation to support a green economy — an economy that is in sync with the natural environment.

With natural resources becoming scarcer, encouraging a more sustainable use of our limited natural resources is essential both for our well-being and for Europe's economic development. One way of doing this is by minimising waste production and reusing waste as a resource. Europe has proven expertise in handling and treating waste and is at the forefront of innovation in this sector.

Capitalising on these strengths would further boost innovative waste prevention and management solutions in order to reduce Europe's dependency on imported raw materials and reinforce its position as a world market leader.

Water is fundamental to human health, food security, sustainable development and the environment. It is also an economic sector of growing importance for Europe with a turnover of some €80 billion a year, making it an invaluable source for growth and jobs. However, water resources are constantly under pressure from climate change, urbanisation, pollution, overexploitation of freshwater resources and increasing competition between various user groups. If we look to the future, without improvements in efficiency, water demand is projected to overshoot supply by 40 % in 20 years' time.

The ability of the economy to adapt and become more resilient to climate change and more resource-efficient, while at the same time remaining competitive, depends on high levels of societal and technological eco-innovation.

SUCCESS STORY: reducing uncertainty in sea-level rise

*Two thirds of our planet is covered with water. Small changes in sea level can have far-reaching consequences, so being able to measure, track and predict potential changes in the oceans is an urgent task for today's scientists. The EU-funded project **Ice2sea** has brought together glaciologists, climate scientists and ocean scientists from 13 countries to give policymakers a clearer picture of future sea-level rise from climate change, and thus to better prepare our society's infrastructures. Set up in response to concerns that projections on future sea-level rise were not precise enough, the **Ice2sea** project has increased certainty in this vital area of research and given the Intergovernmental Panel on Climate Change (IPCC) more reliable data for its latest fifth assessment report (October 2013).*



INCLUSION

Reducing inequalities and social exclusion are crucial challenges for the future of Europe.

EU research based on a strong multidisciplinary approach, including social sciences and humanities, can help address these challenges by exploring new forms of innovation and strengthening the evidence base for policy actions, both at EU and national level. It also promotes coherent and effective cooperation with countries outside the EU and looks at issues such as memories, identities, tolerance and cultural heritage.

SUCCESS STORY: age-friendly environments: a new Europe-wide network on innovation

According to the World Health Organisation, physical and social environments are key determinants of whether people can remain healthy, independent and autonomous long into their old age. Creating age-friendly environments is therefore one of the most effective approaches to respond to demographic change. To support this approach, the **AFE-Innovnet** thematic network on innovation for age-friendly environments (AFE) has kicked off with the support of the EU competitiveness and innovation framework programme's information and communication technologies policy support programme (CIP ICT PSP) and will run for 2 years.



SECURITY

Ensuring the security of its citizens is one of the primary obligations of any country. Without safety and security as its basis, society cannot thrive. Governments keep citizens secure by fighting crime and terrorism, protecting them against natural or man-made disasters, providing effective cyber-security and protecting borders against illegal trafficking.

But while ensuring the security of citizens is an essential task of any administration, it is also a highly sensitive area that needs to incorporate respect for privacy and the safeguarding of fundamental rights. The respect of privacy and individual freedom is thus at the heart of EU security research.

Competitive, EU-based security industries can make a substantial contribution to the quality of life in European societies. EU companies are among the world leaders in most security sector segments thanks to their strong technological innovation.

The security industry is a sector with the potential for growth and employment in the EU.

SUCCESS STORY: EU-funded project to take biometric security systems to the next level

Biometric systems have proved to be one of the most efficient security solutions available today. However, some biometric sensor vulnerabilities still exist, including some which have been well publicised in the international media. The **Tabularasa** consortium comprises 12 different organisations across seven countries that have worked together over a period of 3 years to research as many vulnerabilities as possible, to develop countermeasures accordingly and ultimately to create a new breed of safer biometric systems.



Outlook

There is strong evidence that countries that have historically invested most in research and innovation have outperformed those that have invested less. The European Union has set itself the target of investing 3 % of GDP in research and innovation by 2020, across the public and private sectors combined.

This investment in a healthy, competitive European economy is every bit as important as our commitment to European debt and deficit reduction. Spending 3 % of EU GDP on research and innovation by 2020 could create 3.7 million jobs and increase annual GDP by close to €800 billion by 2025.

With an ageing population and strong competition from emerging economies, Europe's future economic growth and job creation must come from innovation in products, services and business models including public sector innovation.

Investment in research and innovation has a powerful multiplier effect, especially at the European level. Yet Europe is currently spending less than the United States and Japan on research and innovation. We need to up our game to remain competitive, and Horizon 2020 will provide help researchers and innovators to do just that.



Increasing research spending could create millions of new jobs and increase the EU's annual GDP by billions of euros.

Research and innovation policy makes a major contribution to the 10 Priorities of Commission President Jean-Claude Juncker, particularly in support of the Jobs, Growth and Investment Package; in creating a connected Digital Single Market and a resilient Energy Union with a forward-looking climate change policy; in strengthening Europe's industrial base, and in making Europe a stronger global actor.

Find out more

- ▶ **European Commission, Directorate-General for Research and Innovation:** <http://ec.europa.eu/research/index.cfm?pg=home&lg=en>
- ▶ **Horizon 2020 in brief:** <http://ec.europa.eu/programmes/horizon2020/en/news/horizon-2020-brief-eu-framework-programme-research-innovation>
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