The State of European Innovation
October 2014
# Contents

**Executive summary**  
Overview of the paper  
04

**I: The Macroeconomic Context**  
Productivity lags behind  
High debt burdens  
Unfavourable demographics  
Credit growth  
06

**II: The Future of Work**  
The Industrial Internet  
Advanced Manufacturing  
The Global Brain  
10

**III: Innovation in Europe**  
Is Europe already an innovation success story  
Is Europe’s attitude to innovation different - Insights from GE’s Innovation Barometer  
Germany: manufacturing powerhouse  
Infrastructure and innovation: virtuous circle  
12

**IV: Key Priorities for Public Policy**  
Setting the boundary conditions  
Stimulating investments  
Talent Pool  
Innovation and trade  
20

**V: Concluding Remarks**  
27
Executive Summary

The pace of innovation is accelerating, driven by three hugely disruptive forces: the Industrial Internet, Advanced Manufacturing, and the Global Brain.

At GE, we see these three forces as the interdependent elements of a new technological revolution, that we call the Future of Work. The Future of Work is about speed and collaboration; it accelerates innovation and change; it redefines economies of scale, enabling micro factories and new artisanal activities; it reshapes supply chains and distribution networks; it redefines the relationship between employers, who get access to a wider pool of talent; and workers, who gain greater entrepreneurial control over their skills, talent and careers.

This new wave of innovation could bring tremendous benefits for Europe. Already today, Europe sports world-class examples of successful innovation: three European countries, Switzerland, the United Kingdom and Sweden, topped the 2014 Global Innovation Index; Germany is a competitive powerhouse in manufacturing. Estonia is a start-up heaven. But while there are major innovation success stories in Europe, Europe as a whole is not yet an innovation success story.

This is apparent in productivity levels, significantly below those prevailing in the US; and in productivity growth, which, with the exception of Norway and Germany, varies from mediocre to dismal. This helps explain why Europe’s recovery from the Great Recession has disappointed, and growth remains weak through large parts of the Union. Faced with high unemployment, high debt burdens, weak credit growth and adverse demographics, Europe desperately needs stronger productivity growth.

What is holding back Europe’s success on innovation? The 2014 GE Global Innovation Barometer, a survey of executives around the world engaged in innovation strategy, unveils some key issues. First, what we might call ‘an attitude problem’. Compared to other regions, European executives place less emphasis on speed and have less faith in a structured innovation process—relative to spontaneous creation. Greater speed is a defining feature of the new innovation wave, and a structured process is essential to scale the results of innovation. Second, there are four key innovation areas where Europe falls short compared to other regions, according to Europe’s executives: collaboration, the ability to attract private investment, the quality and level of government support to innovation, and the ability to attract and retain talent. It is in these areas the efforts should be intensified.

Faster innovation could bring huge benefits to Europe. It holds the key to strong sustainable growth in jobs and incomes, and is the only way to reconcile the need for fiscal prudence with the desire for a resilient social safety net. But faster innovation hinges on greater efforts by both public and private sectors.

For the private sector, the imperative should be to embrace speed and collaboration, realizing that the new wave of innovation brought forth by the Future of Work requires a complete change of attitudes, based on openness, collaboration, flexibility, and an acceleration of the cycle of design, prototyping, testing and adapting. The private sector should also realize that attracting, retaining and nurturing talent will be an increasingly important competitive advantage.

Private sector investment in innovation should be increased. European private investment in innovation lags behind other regions; private and public sector should collaborate to create more supportive ecosystems comprising research institutions, funding schemes, and a robust legal framework to protect investments and intellectual property.

For the public sector, the overarching priority should be to put in place predictable and viable long-term objectives; innovation pipelines can cover 10-15 years, and the stability and reliability of a policy framework supporting research, technology development and innovation is one of the key conditions for attracting investments and stimulating entrepreneurship. Public support should be focused on a select number of areas critical to building Europe’s competitive advantage and improving living standards: these should include health care, renewable energy, advanced manufacturing and digital technologies such as the industrial internet.

The public sector should also endeavour to bolster the quality of fundamental research, while providing appropriate support for mid-sized projects in applied and technology oriented research. Together with a more business friendly environment, and stronger support for start-ups and SMEs, this would create the conditions for innovation to accelerate and be quickly translated into new products and services.

One issue of concern is the potential skills gap that is emerging in Europe which has a real risk of inhibiting innovation and growth potential. Even today when unemployment is so high in many parts of Europe, there are more than two million vacancies that cannot be filled, many of which are in high tech innovation driven sectors.

When it comes to innovation, Europe’s size and diversity is a key strength which
needs to be exploited to best effect. Europe should establish a Single Market for innovation, an ecosystem to reduce bureaucracy, allow greater cross border co-operation and promote the development and mobility of talent and skills. Examples of successful pan-European innovation collaboration already exist—such as the Biobased Industries Consortium—they should be scaled and multiplied. Public-private partnerships (PPP) or looser clusters should be encouraged by governments as a further accelerator.

Infrastructure deserves special attention. Innovation and infrastructure go hand in hand. Infrastructure is a key enabler of innovation: communications infrastructure is essential to the collaboration that is at the heart of the global brain, and to the digital thread of advanced manufacturing; power distribution infrastructure is key to the generation of new ideas and their translation into products, and transportation infrastructure helps translate it all into revenues, wages and profits. Conversely, innovation can dramatically increase the efficiency and productivity of infrastructure, as well as its reach. In the case of the European Union there is an added dimension, as infrastructure is a primary arena for cross-country collaboration, essential to turn twenty-eight different countries into the world’s largest economy. In fact, the benefits of a common infrastructure have always been at the heart of the European projects, including the idea of a common currency. The high-speed train infrastructure in Europe is a perfect example of this synergy.

Embracing the new innovation wave of the Future of Work can transform Europe’s economies and boost the living standards of its citizens. But with an accelerating pace of innovation in a highly competitive globalized economy, the costs of inaction are equally high. The alternative Europe faces is simple: innovate or stagnate.

Overview of the paper
The rest of the paper is organized as follows — Section 1 outlines the macroeconomic background, assessing Europe’s growth (under)performance and the main economic challenges ahead; Section 2 summarises GE’s vision of the Future of Work, highlighting the key features of the Industrial Internet, Advanced Manufacturing and the Global Brain.

Section 3 looks at the current innovation landscape in Europe. It highlights some of the success stories and discusses the main shortcomings and challenges, including some insights from GE’s Global Innovation Barometer. Section 4 gives our perspective, as an investor in innovation in Europe, on some of the key priorities for public policy action. Section 5 concludes.
I. The Macroeconomic Context

That Europe has a growth problem is clear. The recovery from the Great Financial Crisis and the ensuing recession has been much weaker in Europe than in the United States—with the exception of Germany.

According to the latest IMF forecasts, by the end of 2014 real output in Canada will be 11% higher than in 2007; in the US nearly 8% higher; in Germany it will be about 6% higher; the gains however will be only under 2% for the United Kingdom and less than 1.5% in France; in Spain and Italy output will still be well below the 2007 level, by 5% and 8% respectively.

The UK recovery has been gathering momentum over the last couple of years, whereas the Eurozone’s recovery appears more fragile—as underscored by the stagnation recorded in Q2 2014. This weak performance has generated a sometimes contentious debate on the best policy response, and the focus has been too often on the classic instruments of fiscal and monetary policy. Some experts and commentators argue that weak growth is due to a misguided insistence on fiscal consolidation - austerity. Others insist that the only answer lies in a more powerful response by the European Central Bank, including a quantitative easing along the lines seen in the US and Japan.

Adverse shocks have no doubt played an important role: after the global financial crisis, the Eurozone faced a debt crisis that at its peak led some economists and investors to fear the common currency might disintegrate. These concerns were unfounded, and have been dispelled by a forceful commitment on the part of the ECB. But they have left the area with a strong focus on debt reduction, and on the need to deepen banking and fiscal integration. The latter raises economic and political issues that go well beyond a standard macroeconomic response to a downturn—and make traditional fiscal stimulus harder to implement at this juncture.

An important complicating factor is the unevenness in performance across EU countries. In the recent recovery, the economic performance within Eurozone members has taken divergent paths, with so-called “core” countries seen as strong, in contrast to the “weak” periphery. But even within each category there are important differences.

In the periphery, Ireland and Spain are now experiencing a more robust recovery, having put in place substantial adjustment measures. Greece and Portugal still lag behind. Among core countries, Germany remains very resilient, despite recent softness in large part due to the crisis in Ukraine. France, on the other hand, seems to be struggling to generate faster growth. Italy, traditionally a “core” country, joined the ranks of the “periphery” during the crisis, and its economy has contracted in eleven of the twelve quarters between June 2011 and June 2014.

Productivity Lags Behind

While adverse external shocks have played a part, the fact that the recovery has been so disappointing, and so much weaker than in some other advanced economies, raises one fundamental question: to what extent are Europe’s problems deeper and more structural? Does Europe have a productivity problem? While monetary and fiscal policy can do a lot to manage the economic cycle, it is ultimately productivity growth that drives any improvement in per capita incomes and living standards. And productivity growth in Europe has been less than impressive in recent years.
Chart 2 above plots labour productivity measured as output per employed person. In the post WW II period, European countries started with a substantial productivity disadvantage compared to the US. Then, as capital was rebuilt and new technologies introduced, they started catching up, especially during the 1970s and 1980s. In the 1990s, however, labour productivity in the US accelerated, and Europe once again fell behind. Only Norway was able to keep up with and even exceed the US, but it too fell behind after the global financial crisis. Between 2003 and 2013, labour productivity in the US has increased by 14%; in France, Germany and the UK by less than that: 7%, 6% and 6% respectively; in Italy it declined by 3%. Only Spain and Portugal post increases similar to the US, but both were starting from a much lower base.

Comparisons of labour productivity, especially between Europe and the US, have been hotly debated. Some European economists have argued that rather than measuring output per worker, one should measure output per hour worked. Olivier Blanchard, currently Chief Economist of the International Monetary Fund, observed years ago that Europeans expressed a clear and legitimate preference for leisure compared to Americans: they worked fewer hours, but in those hours were as productive as their counterparts across the Atlantic. While this was broadly true in the mid-1990s, it is much less true today, however. Chart 3 plots GDP per hour worked, always in PPP terms:

On this metric, Norway is an overachiever. Other European countries, however, have lost ground to the US. The picture is very similar to that in Chart 2: Over the last ten years the improvement in France and the UK (6%) has been less than half that recorded in the US (14%); Germany has done better (10%) and Italy has stagnated (1%).

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These productivity statistics send two clear messages:

1. Labour productivity growth in Europe is very uneven, with strong performance in some countries (Norway and to some extent Germany), middling in others (France, UK) and dismal in Italy.

2. Productivity levels overall are significantly below those prevailing in the US. In terms of output per worker, France, Germany and Italy are ~25-30% below the US; in terms of output per hour worked France is 12% lower, Germany 15%, Spain 26% and Italy 33%.

These comparisons are not meant as a beauty contest. They are meant to illustrate that European countries have the potential to achieve much higher levels of productivity and competitiveness.

Boosting competitiveness is especially important as Europe still faces some very substantial challenges.

High Debt Burdens

Debt to GDP ratios in the EU have increased substantially since the onset of the global financial crisis. Governments tried to cushion the impact of the downturn with expansionary measures, took on their books some of the excess private sector debt, and suffered the reduction in revenues triggered by the recession.

The tensions experienced during the Eurozone debt crisis then highlighted the importance of placing debt ratios on a sustainable path. There is currently a fierce debate on the right degree and pace of fiscal consolidation. But is fiscal austerity a headwind to productivity and competitiveness? To the extent that austerity reduces the resources available for public investment in infrastructure and education, it is very likely to have a damaging impact on productivity.

Europe’s productivity problem, however, is long-standing and predates the crisis. Moreover, as in many countries public spending is in the region of one-half of GDP, it should be possible to implement fiscal consolidation while safeguarding productive public spending.
Unfavourable Demographics

European populations are ageing. While other advanced economies (and some emerging ones) face the same problem, European countries display some of the most challenging demographic trends. Population ageing has an important impact on public finances: on current demographic trends, the generous pension regimes adopted decades ago would be unsustainable, and pension reforms have been undertaken or are being considered to reduce the weight of pension spending. Ageing also puts pressure on healthcare spending. These pressures absorb resources, and require either tax increases—which can raise the cost of doing business—or cuts in other areas of spending, which might include public infrastructure investment.

The impact of ageing can be mitigated by increasing the retirement age, and/or by allowing stronger immigration to boost the labour force. But raising labour productivity would also help.

Credit Growth

Credit growth in Europe is currently rather weak. During an economic downturn it is always difficult to distinguish the impact of credit supply and credit demand, and there is evidence that demand for credit is depressed. In other words, one reason why credit is not currently flowing into the system is that in many EU countries both corporates and consumers lack the confidence to consume and invest. We also know, however, that the European banking sector is still recovering from the impact of the financial crisis. Within the Eurozone in particular, banks face a new round of stress tests, and are in the process of bolstering their capital ratios.

In addition, the Eurozone debt crisis has caused some fragmentation in the Eurozone financial market, with banks concentrating more of their lending within their respective national borders—partially reversing a trend of cross-border banking.

The net impact of all this is an increased difficulty for European businesses to obtain credit. This is particularly the case for SMEs, and the problem is particularly acute in countries that have been more severely affected by the debt crisis, and where the cost of funding has remained higher than elsewhere in Europe. This problem is especially troubling because European firms are much more reliant on bank credit than US firms. The fact that SMEs are more affected is also a concern. According to GE’s 2014 Global Innovation Barometer 85% of innovation executives believe collaboration with start-ups and entrepreneurs will drive innovation success in the future. How can these SMEs thrive without funding, and how can large companies innovate if SMEs are not being supported?
II. The Future of Work

The pace of innovation is accelerating, driving a powerful and far-reaching transformation of industry. This transformation affects design and manufacturing processes, supply chains and distribution networks, and the way that work is performed and organized. It is redefining the competitive landscape across industrial sectors, and will impact international trade patterns and the distribution of global growth. It will reshape the labour market and affect the level and distribution of incomes across countries.

At GE, we call this transformation the Future of Work. It is driven by three fundamental forces: the Industrial Internet, Advanced Manufacturing, and the Global Brain. These three forces are interdependent and mutually reinforcing.

The Industrial Internet
The Industrial Internet is the merger of software and hardware, of big data and big iron, with the integration of cloud-based analytics with industrial machinery. The rapid decline in the price of electronic sensors today makes it cost-effective to equip industrial machines with a large number of these sensors that make them increasingly able to analyse their environment, react, and interact with each other and with us. At the same time, lower costs of storing and processing data are enabling us to harvest massive amounts of data from industrial equipment and to process it with increasingly advanced analytics, generating insights that allow us to operate the equipment more efficiently. The Industrial Internet allows us to shift from reactive to preventive maintenance, fixing machines before they break, dramatically reducing unplanned downtime and raising the efficiency of individual machines as well as entire systems: reducing delays in hospitals or air traffic, increasing the efficiency of power distribution.

Advanced Manufacturing
The second driving force is Advanced Manufacturing. At the core of Advanced Manufacturing is a digital thread that links together design, product engineering, manufacturing, supply chain, distribution and remanufacturing (or servicing) into one cohesive and intelligent system. This encompasses new production techniques like additive manufacturing, or “3D printing”, which allow us not only to create completely new parts and products with new properties, but also to accelerate the cycle of design, prototyping and production. Engineers today can “print” a prototype, test it, adjust the digital design as needed and reprint an improved version—all using the same additive manufacturing machines. This translates to increased speed and flexibility of production, at lower costs. Moreover, the digital thread connecting all aspects of the manufacturing process also allows for real time adjustments to the production process and to supply and distribution logistics.
The Global Brain

The third driving force is the Global Brain. This is essentially the collective intelligence of human beings across the globe, integrated by digital communication networks. Many of us take for granted the ability to cooperate seamlessly with colleagues in different locations via email, cloud-based file sharing platforms, tele- and video-conferencing. Today, open-source platforms and crowd-sourcing are quickly emerging as the most effective ways to unleash the creativity and entrepreneurship potential of the Global Brain. Individual companies are starting to gain expertise that extends well beyond their four walls, accessing a larger pool of talent which can vary depending on the problem at hand. Companies gain flexibility. Workers, on the other hand, gain greater entrepreneurial control over their skills and talents. The Global Brain will gradually redefine the relationship between employers and employees, to the benefit of both. And the process will be magnified as global economic growth brings millions more people both connectivity to the internet and the time to take advantage of it. Better access to clean water, food and healthcare will free up precious hours, while improving health and longevity.

The Future of Work is shaping up to be a powerful accelerator for the traditional innovation process. The digital world has long enjoyed the benefits of Moore’s Law, manifested in exponential growth of cost-adjusted performance. As digital and physical become intertwined, some of these benefits will accrue to the world of industrial equipment. Of course, physical machines are still subject to physical laws that impose more binding constraints than in the world of software—but as they become increasingly digitised, the pace at which their performance improves will experience a significant acceleration. The Global Brain will accelerate new discoveries through at least two channels. First, by a sheer increase in the number of people able to participate in the innovation process; second, through the increased scope for collaboration, which will make the Global Brain the human equivalent of High Performance Computing5. At the same time, the greater flexibility and speed introduced by Advanced Manufacturing will allow the industrial system to quickly adapt and translate new innovations into new technologies deployed across sectors.

Innovation is disruptive, and this fast-paced innovation will be even more so. It will present new challenges for individual companies. It will have painful short-term costs in segments of the labour market, as some jobs will be displaced and some skills made obsolete. But for companies and individuals alike, innovation will also be a major source of opportunities, opening up new markets and careers. At a time of persistently low economic growth and high unemployment, it is natural to feel more threatened by the added challenges that innovation brings. But today innovation is the primary force that can ensure sustainably higher growth in jobs and incomes. In an increasingly globalised economy, embracing the disruptive forces shaping the Future of Work will be essential to remain competitive and take advantage of the rapid growth of global markets.

4See Annunziata, Marco and Evans, Peter “The Industrial Internet: Pushing the boundaries of minds and machines”, GE White Paper, Month 2012; and “The Industrial Internet @ Work”, GE White Paper, Month 2013
5High Performance Computing leverages the power of “clusters” of interconnected computers, referred to as “nodes”. The coordinated computing power of the nodes delivers much higher performance, enabling to solve large-scale high-complexity problems in business, science and engineering.
III. Innovation in Europe

The disruptive forces shaping the Future of Work could be leveraged to reboot Europe’s productivity, fuelling sustainable high growth in jobs and incomes, and helping reconcile prudent debt management with a resilient social safety net. But is Europe positioned to exploit this opportunity?

Innovation can only unleash its full potential in an environment where the key enabling conditions are in place: one in which government supports the innovative process through investment and a regulatory environment that ensures the protection of intellectual property, does not impose laws that stifle business processes, and that is open to foreign investment to help seed innovative plans; one in which businesses are open to and agents of change, investing in and adopting the latest technology; one in which the education of the population and enrichment of the workforce is a top priority.

Chart 5 – Global Innovation Index - Top Ten

Is Europe already an innovation success story

The focus on Europe’s growth challenges should not obscure the fact that some EU countries already excel in innovation and competitiveness.

Switzerland, the United Kingdom and Sweden topped the 2014 Global Innovation Index—the leading benchmark based on a survey of 143 economies around the world on 81 indicators, to gauge both their innovation capabilities and measurable results. Finland and the Netherlands helped Europe complete a clean sweep of the top five positions in the annual rankings published by Cornell University, INSEAD and the World Intellectual Property Organisation. These global innovation leaders have created well-linked innovation ecosystems, where investments in human capital combined with strong innovation infrastructure contribute to high levels of creativity. Their key areas of strength are innovation infrastructure, including information and communication technologies; business sophistication such as knowledge workers, innovation linkages, and knowledge absorption; and innovation outputs such as creative goods and services and online creativity.

Except for the UK, however, Europe’s global innovation champions are relatively small economies. For innovation to truly transform Europe’s large economy, it needs to become much more pervasive. There are major innovation success stories in Europe, but Europe is not yet an innovation success story.

4https://www.globalinnovationindex.org/ (Cornell University, INSEAD, WIPO)
Sweden: A European success story

Sweden is ranked in the top three places in the Global Innovation Index, the Innovation Capacity Index and the European Commission’s Innovation Union Scoreboard. According to the Innovation Union, Sweden outperforms the EU average in 23 of 26 indicators covering human resources, research systems, finances, entrepreneurship, intellectual assets, innovating industries and economic effects. These strengths are built on a high rate of R&D investment (public and private) at just under 3.4% of GDP. However, an area for concern is that Sweden significantly underperforms in the share of sales of new innovations, a key measure of innovation productivity.

Vinnova, Sweden’s innovation agency (Vinnova.se), has overall responsibility for innovation issues working closely with Tillväxtverket (Agency for Economic and Regional Growth) to implement key EU programs in Sweden such as Horizon 2020. A national innovation strategy has been launched with the following vision for 2020: Sweden is a country characterized by innovative ideas and pioneering new ways of thinking and acting to shape our future in a globalized world. People in all parts of Sweden can and will contribute to creating value for people, the economy and the environment through new or better solutions.

This strategic vision is met through the delivery against objectives set in six areas:

- Innovative people
- High quality research and higher education for innovation
- Framework terms and infrastructure
- Innovative companies and organisations
- Innovative public sector organisations
- Innovative regions and environments.

Fig 1. GE technician at work in Uppsala, Sweden
Is Europe’s attitude to innovation different - Insights from GE’s Innovation Barometer

Is there something specific in Europe’s attitude to innovation that constrains the region’s success? The results of GE’s Global 2014 Innovation Barometer, a survey of 3,000 executives in 28 countries across the globe, reveals that European firms have a different attitude to innovation than firms across the rest of the world:

Less emphasis on speed

We have noted that Advanced Manufacturing techniques are fuelling a trend toward greater speed – adopting a test fast, fail fast, adjust fast approach. A shorter design-prototype-manufacture cycle allows companies to bring new ideas to market more rapidly. Our Global Innovation Barometer reveals this move toward speed is not as prevalent in Europe as it is in other parts of the world.

Less faith in a structured innovation process

Compared to executives in other regions, European executives feel that successful innovation is driven spontaneously, through interactions of creative individuals. While individual creativity is an essential ingredient of innovation, structured processes are useful to foster innovation and scale its results. The Innovation Barometer’s results may indicate that the processes in place in Europe are not seen as effective.
GE’s Innovation Barometer suggests that European firms and economies are falling short in four key innovation areas:

Ability to attract private investment

Only one third of Europeans think it is important to attract investors to fund innovative programs—and yet private investment is all the more important at a time when governments are cash-strapped. Also, Europeans feel that SMEs are driving innovation, whereas in the rest of the world innovation is seen as driven by large multinational companies that have a successful localisation strategy.

Collaboration

Over the last two years, GE’s Innovation Barometer has shown that collaboration with governments, customers, and other external third parties is a key trend among companies looking to innovate. Two years ago this was seen as a future trend, and this year collaboration has been put into action, with 64% of respondents to the survey saying that revenue and profit from collaborative activities has increased over the past year. Over half of respondents work at companies that embrace open source innovation and one-third have utilised crowd sourcing to solicit innovative contributions to the business. However, European respondents are more likely to want to contain the innovative process within existing lines of business and teams, and less likely to believe that innovation is becoming global and that firms need to share talent insights and resources across the globe. Moreover, Europeans prefer subsidies going to domestic innovators, but at a time when domestic investment is limited because of a weak economy, enticing foreign investment could be especially helpful.

Government support

Compared to half of respondents in the rest of the world, only about one third of Europeans believe that governments and public authorities allocate an adequate share of their budgets to support innovative companies. Nearly 70% believe that public authorities do not do enough to support SMEs in their innovation efforts. Less than 30% of respondents feel that government support for innovation is efficiently organised compared to over 40% for the rest of the world. Less than half feel that international trade regulation and agreements are favourable to innovation.

Talent

European executives are less likely to believe attracting and retaining talent, adopting emerging technologies and encouraging disruptive and creative behaviour are as important as executives from around the world do. While 85% of US and 80% of UK executives feel this is important, respondents from the continent were less likely to feel retaining talent is important, with 76% of Polish, 75% of Swedish, 71% of Germans and 67% of French feeling this way. Only Italian respondents were on a par with the US at 85%.

These are four areas where Europe needs to step up its efforts to better develop an environment that can promote innovation. These results from the Innovation Barometer also suggest that there is a need to change attitudes and strategies in both the private and public sector.

Firms need to adopt a more open attitude: open to collaboration with external partners, and open to foreign investment. Governments need to rethink the policies and funding devoted to supporting innovation, as current efforts are clearly perceived as insufficient. Both private and public sector need to work together to develop and retain the right talent.
Important efforts in this direction are already underway. In 2010, the European Union launched Innovation Union.

The Innovation Union is a strategy to create an innovation-friendly environment. One of the seven flagship initiatives of the Europe 2020 strategy, Innovation Union aims to boost the region’s R&D spending to 3% of EU GDP by 2020 (from less than 2%); the EU estimates this could create 3.7 million jobs and increase GDP by €795 billion by 2025. Europe currently spends less on R&D than the US and Japan, and emerging markets are catching up fast.

**Horizon 2020**

Key to the success of the Innovation Union is the €80 billion investment of funding over the 2014-2020 timeframe called Horizon 2020. To simplify the process to apply for and administer grants, Horizon 2020 brings together a previously disparate group of funding streams under three pillars:

- **Excellent Science**: extend the excellence of the Union’s science base to make the Union’s research and innovation system more competitive on a global scale

- **Industrial Leadership**: speed up development of the technologies and innovations that will underpin tomorrow’s businesses and help innovative European SMEs to grow into world-leading companies

- **Societal Challenges**: reflect the policy priorities of the Europe 2020 strategy and address major concerns shared by citizens in Europe and elsewhere

**Public-private and public-public partnerships**

These are one of the key elements of Horizon 2020. To date, the private sector has committed to invest nearly €10 billion in Joint Technology Initiatives. In addition, eight contractual Public Private Partnerships in areas such as electric vehicles, green buildings and advanced manufacturing processes have been launched, leveraging over €6 billion of investment.

Compared to the previous European R&D programs (FP and CIP), the Horizon program provides a renewed opportunity to increase the European industry innovation footprint in Europe. Firstly, the funding rate of 100% makes the program more competitive compared to other regions than in the past. Secondly, the project typology fits both the European industry better and meshes with the emerging trend toward speed to market; there is more emphasis on demonstration and pilot projects and less on fundamental research. Thirdly, the topics that will be funded match the European industry core business and strategy much better. The focus of the Innovation Union is on key areas such as climate change, energy efficiency and healthy living; topics that have been introduced include shale gas, flexible power plants and the industrial internet.

On the other hand, two aspects may still be an issue. First of all, timing remains a challenge. Although the total cycle time has been reduced from the historical 300 days, still a substantial amount of time is needed in between application and grant agreement. This means that only strategically important projects with a long term commitment are suitable for EU funding. Secondly, some of the (perceived) IP issues also remain. The demand from some parties for a “Europe First” strategy and over-regulation may deter industries from participating in EU funded projects. In our opinion, the handling of IP rights should be left to the parties involved.
Germany: manufacturing powerhouse

More than 30% of the European GDP is generated in Germany and of that, industry is a major pillar that accounted for more than 30% of national GDP in 2012. Manufacturing represents more than two thirds of this, and employs ~30% of the workforce. This lower reliance on the service sector compares favorably with the much lower industrial output of 21% in the UK and 19% in France. A key sector is the SME manufacturing firms known as the Mittelstand which often specialise in high-tech niche products, and which form a major part of the German economy. An estimated 1,500 German companies occupy a top three position in their respective market segment worldwide. In about two thirds of all industry sectors, German companies belong to the top three competitors worldwide.

To maintain this strong global footprint, the German government has launched the Industry 4.0 initiative as part of its overall “high-tech strategy”. The initiative is funded with €200MM across several ministries and promotes concepts such as Smart Production and the Smart Factory, which are characterised by digitalization, interconnection, adaptability, resource efficiency and ergonomics as well as the integration of customers and business partners in business and value processes. Current lighthouse projects are run by “Clusters of Excellence” consisting of several participants from industry and research. The governmental Industry 4.0 initiative is strongly backed by important industry associations such as VDMA, ZVEI and BITKOM who have launched the “Platform Industry 4.0”, and includes industrial heavyweights like Bosch, Siemens, Deutsche Telekom and SAP.

An organisation that shapes innovation processes in Germany and drives forward the development of key technologies - such as Advanced Manufacturing - is the Fraunhofer-Gesellschaft. With a workforce of over 23,000, the Fraunhofer-Gesellschaft is Europe’s biggest organisation for applied research, and currently operates a total of 67 institutes and research units. Its core task is to carry out research aimed at practical applications in close cooperation with its customers from industry and the public sector. Several different Fraunhofer units are currently engaged in developing new concepts and solutions to merge the physical world with the virtual world and make production and factories smarter. According to Fraunhofer and BITKOM the underlying market potential of these concepts is an additional €78 billion gross value added until 2025 in Germany alone.

Estonia: Start-up heaven

Estonia, a country with 1.3 million inhabitants, holds the world record in start-ups per person. It has embraced digital technology much faster than most other European countries. After gaining independence from the Soviet Union, Estonia was left with little public infrastructure and virtually no commercial activity. As it needed to build high-functioning government services for its residents and the emerging private sector, Estonia’s government focused on technology, investing aggressively in efforts to bring services and citizens online. A high level of technology adoption and the lack of bureaucracy created a fertile ground for start-ups. Estonia is homeland to Skype, Kazaa, TransferWise and Playtech, among others. Given the country’s tiny domestic market, start-ups have been forced to think global. The government builds bridges between Estonian start-ups and global investment funds and venture capital providers. It also established its own seed fund for start-ups.
Infrastructure and innovation: virtuous circle

Innovation and infrastructure go hand in hand. Infrastructure is a key enabler of innovation: communications infrastructure is essential to the collaboration that is at the heart of the global brain, and to the digital thread of advanced manufacturing; power distribution infrastructure is key to the generation of new ideas and their translation into products, and transportation infrastructure helps translate it all into revenues, wages and profits. Conversely, innovation can dramatically increase the efficiency and productivity of infrastructure, as well as its reach. In the case of the European Union there is an added dimension, as infrastructure is a primary arena for cross-country collaboration, essential to turn twenty-eight different countries into the world’s largest economy. In fact, the benefits of a common infrastructure have always been at the heart of European projects, including the idea of a common currency.

High-speed trains

The high-speed train infrastructure in Europe is a perfect example of this synergy. There has been a strong upswing in the demand for high-speed rail services in Europe, and this is expected to rise even faster between now and 2020. By then long distance rail traffic will represent around 315 billion passenger-kilometers (pkm) annually, an increase by two thirds since the turn of the century. The traffic demand on medium distances (typically under 3 hours) has also increased six times in the last 20 years. Leading operators of high speed trains remain the historical national operators: Deutsche Bahn in Germany, Renfe in Spain, SNCF in France and Trenitalia in Italy who are preserving European leadership in the high-speed lines, with the support of the European Union and its vision of a Single European Railway Area and Trans-European High-Speed rail network.

The growth of the high speed train market in Europe has been possible due to a large number of small innovations rather than the introduction of radically different technologies. European engineers have improved the aerodynamics of vehicles, designed robust wheels, introduced more efficient brake systems and improved on the powertrain such that the trains achieve a speed of 200 mph and bring the medium distance lines below 3 hours. However, further development is needed and this is not possible without a co-ordination at a European level.

The EU started government-funded research and innovation programs while setting the imperatives on improving the quality of rail services by increasing reliability and punctuality, reducing combustion and CO2 emissions, while doubling railway capacity, and cutting the cost of infrastructure and rolling stock. Additionally it sought to retain Europe’s leadership in the global rail market. The “Shift to Rail” EU program drives the innovation on railways. The EU together with rail industry leaders and manufacturers focus on five key Innovation Programs: cost efficient and reliable trains, including high speed trains and high capacity trains; advanced traffic management & control systems; cost efficient and reliable high capacity infrastructure; IT solutions for attractive railway services; and technologies for sustainable & attractive European freight. Efforts in these areas hold the promise of making the European railway network even more efficient, lowering transport costs, while stimulating new technological advances that could also find applications in other industrial fields.
IV. Key Priorities for Public Policy

The discussion in the previous sections shows that while Europe already sports some areas of technological excellence, innovation needs to be raised to a higher level, and public policy has a very important role to play—both at the national and at the European level.

The 2013 EU Innovation Scorecard (European Commission) again shows that South Korea, the US, and Japan have a performance lead over the EU. South Korea’s lead is increasing, but since 2008 the EU has been able to close almost half its gap with the US and Japan. The EU still lags considerably behind the global leaders notably in terms of business R&D expenditures, public-private co-publications, and patents, as well as in tertiary education. The EU continues to perform better than Australia, Canada, Brazil, Russia, India, China and South Africa. This lead has been declining with China, remained stable with the other BRICS countries and has been increasing compared to Australia and Canada.

Setting the boundary conditions

Long term objectives and focus

Governments need to have long-term objectives in place and these objectives should not be volatile but predictable and viable. While establishing long term objectives, one should take into account that innovation pipelines may cover 10-15 years. This means that a government’s objectives have to overarch the usual election periods (4-5 years) and need to be embedded on an operational level in the relevant ministries and government agencies. Reliability of a policy framework supporting research, technology development and innovation is one of the key conditions for attracting investments and stimulating entrepreneurship. Governments should create boundary conditions supporting their long term objectives, leaving the specifics of R&D efforts to industry and academia.

The current way most European governments stimulate innovation resembles the model of ‘shared poverty’. Everyone gets a share of government funding, enough to survive, but not enough to thrive. Instead of promoting regionalism and spreading R&D investments, efforts should be focused on a select number of areas deemed critical for the future of Europe’s competitive advantage in the 21st century. Focus areas can include current fields of strength of the European industry, like renewables, or topics of emerging importance for European societies like healthcare under conditions of profound demographic change. Also, potentially revolutionary developments in the Industrial Internet and Advanced Manufacturing should be high on the priority list. Lastly, as pointed out in GE’s Innovation Barometer, collaboration is a key to success, since this creates synergies instead of competing silos.

A Single Market for Innovation

When it comes to Innovation, Europe’s size and diversity should be a key strength which needs to be better exploited to best effect. The United States and European Union differ significantly in terms of their innovative capacity: the former has been able to gain and maintain world leadership in innovation and technology while the latter continues to lag.

The higher mobility of knowledge, capital, and population in the US not only promotes the agglomeration of research activity in specific areas of the country but also enables a variety of geographic mechanisms to fully exploit local innovative activities, synergies and regional resources. This contrasts with the situation in the EU where imperfect market integration and institutional and cultural barriers across the continent prevent those engaged in driving innovation from maximising the benefits from external economies and localised co-operation. Compensatory forms of geographical process may be emerging together with greater European integration.

If driving innovation across Europe is a serious goal – a Single Market for Innovation across the EU needs to be created: an innovation ecosystem from ideation to commercialisation, which will reduce bureaucracy, allow greater cross border co-operation and promote the development and mobility of talent and skills.

Addressing Cultural Barriers

Entrepreneurship is an important driver of economic growth and innovation. According to the Global Entrepreneurship Monitor (source: Global Entrepreneurship Monitor 2013 Global Report) the rate of entrepreneurship in Europe is lower when compared to Brazil, China, India, South
Driving innovation across Europe: The Bio-based Industries Consortium

The Bio-based Industries Consortium (BIC), a cross-sector group of 48 large and small companies, has joined forces with the European Commission to set up a public-private partnership (PPP) worth €3.8 billion to accelerate the deployment of biobased products in Europe by 2020. Investments in bio-based innovation from 2014 to 2020 will include €975M of EU funds and €2.7 billion of private investments, as well as leveraging capital markets and additional private and public funds (e.g. synergies with EU Structural Funds). The key objective is to develop new biorefining technologies to sustainably transform renewable natural resources into bio-based products, materials and fuels. Through financing of research and innovation projects, the BIC will create novel partnerships across sectors, such as agriculture, agro-food, technology providers, forestry/pulp and paper, chemicals and energy. The initiative is dedicated to breaking Europe’s dependence on fossil fuels by converting biomass and wastes into greener everyday products.
overtime as many young entrepreneurs and innovators will themselves become parents. For governments educational policies and the role of mass media (including social media) should be a strong focus.

In terms of wider policies governments can create the environment which rewards and facilitates tolerable risk and does not adversely punish failure. We have noted earlier in this paper that the most recent waves of innovation are spurred by a ‘design fast, test fast, fail fast’ attitude, where failure is seen as a temporary step towards success—not an unremovable stigma. This should include a common framework of support including changing bankruptcy laws across Europe. The OECD in its 2013 paper Supporting Investment in Knowledge Capital, Growth and Innovation has called for the laws to be changed in the EU.

**Fostering Ecosystems**

Private investments represent a substantial share of all R&D spend in developed economies, but as mentioned in previous chapters, European private investments in innovation lag behind other OECD countries. The external environment in which a company and its R&D are embedded exerts a strong influence on the odds of success for industrial research. The role of government in fostering an ecosystem of excellence in technology, entrepreneurship, and innovation in a state or region is often underestimated. Yet, the quality of this ecosystem does depend on a number of factors all of which government policies and actions directly influence to a significant extent. Among these are the existence of a solid infrastructure of research institutions and cutting-edge facilities; the training of scientific and technical talent; funding schemes to stimulate the pursuit of new ideas and concepts or new businesses in selected areas; and – of course – a robust legal framework to protect investments and intellectual property. All of these contribute to how attractive it is for the private sector to invest in R&D and product development at a given location.

**Stimulating investments**

**Public Investment**

The domain most subject to government influence is fundamental research. In Europe, for example, the vast majority of universities and research organisations are public entities. Investment in and direction of fundamental research are hence linked to political priorities to a significant extent. Growing fundamental research capabilities to support an existing local industry that is able to translate new ideas can be a powerful means to bolster regional competitiveness. However, fundamental research is most effective when it is collocated with other public and private-sector entities, which know how to absorb new insights and translate these into practice. This ensures that an existing local technology industry can tap into a pool of qualified talents which they need to succeed.

A critical ingredient of regional competitive advantage is government programs for financial support of (mid-sized) projects in applied and technology-oriented research. Funding programs can help
support a policy agenda striving to increase competitiveness and structural transformation in a region. For companies, government cost share is in effect a form of risk mitigation which allows them to venture into new domains while limiting financial exposure. Hence, grants can stimulate industrial engagement in technology domains that the government deems relevant for the future. Since grants will only support the initial R&D phase where technical risks are highest, they do have a significant multiplier effect in case of success.

Government policies should focus on creating business friendly terms & conditions. Too often, governments forget that, in an increasingly globalized world, competition for R&D investments exists between different parts of the world today and incentive programs should therefore not be structured with sole consideration of national or internal markets. This is true especially for investments in advanced technologies which are new, largely unchartered, and not yet commercialised. Such technologies are less tied to specific market conditions and can be investigated almost anywhere provided the right talent is available. At the same time, these are the domains that may offer the strongest growth prospect for the future.

For example, on an EU level, grant terms and conditions at times appear to be structured with sole consideration of the internal market, not recognizing that large companies may preferentially invest in research activities wherever public funding programs are most attractive. Another policy element intended to attract investment in R&D are tax incentives, which provide a ‘below the line’ benefit, as opposed to cash grants for research projects. In a globalised economy, tax incentives have become an effective tool to create regional competitive advantage.

Obviously, in order to benefit from such incentives, it is necessary to make a profit in the first place. Therefore, tax incentives are primarily aimed at established corporations and less useful to start-up companies. Tax incentives are a good instrument to attract and maintain R&D activities in a certain country or region. As a matter of fact, the top 10 criteria for large corporations to invest in a certain country or region also include tax driven measures. Most EU member states (but also the US) have R&D tax incentives in place, in several varieties. These include tax credits on wages, (super) deductions on R&D expenses, tax credits on the increment of R&D expenses, innovation box (lower tax rate on profits) or a combination of these. For the industrialised world, tax incentives can also be beneficial in the competition with emerging economies that still have an advantage from a labour cost perspective.

French R&D tax credit

The goal of the research tax credit is to improve French competitiveness through the promotion of R&D investments and thus innovation. In an economic context of slow growth, many efforts are made to restore the competitiveness of French companies and create a friendly innovative environment to attract investments. The idea is now commonly shared that a strong and competitive industry, able to make technology intensive products, is the only way to revive growth. The creation of a high level of value-added is a necessity if a Japanese-style lost decade is to be avoided. The research tax credit is part of this effort.

All companies are eligible for this tax credit that covers 30% of R&D expenses up to €100 million, and 5% above this threshold. Although the research tax credit is not a new measure, its scope has been expanded in 2013 to cover SME innovation expenses. The success of this powerful incentive is undoubted. It is the most used similar tax credit in Europe: a survey showed that 64% of French companies benefited from it and more than 60% of them have launched an R&D program in France. But French companies are not the only beneficiaries: in 2010, 2,000 foreign companies benefited from it. The result is the very impressive number of 199 new R&D investments in France, made by these foreign companies between 2008 and 2012.

The State of European Innovation 23 of 28
Public-Private Partnerships (PPP) and Clusters

For tackling complex challenges in a comprehensive way – from fundamental and applied research to development of solutions and large-scale demonstrator programs – public-private partnerships (PPP) or looser clusters should be encouraged by governments. PPPs foster strong linkages between the public and the private sector, and they have shown to be an effective means of crossing the chasm that too often exists between academia and industry. While partnerships between the public and private sector are also expected in many research funding programs, experience shows that a close collaboration is rarely accomplished this way. It even can result in token expressions of goodwill to cooperate without substantial engagement. PPPs, where much more is at stake for all parties involved, can ensure the efforts get intertwined through joint objectives and mutual dependencies. This increases the level of commitment at both ends. Where more appropriate, depending on the technology area and maturity, clusters can be created providing an ecosystem where academia, start-ups, SME’s and the industry can work closely together in the innovation value chain. Clusters can especially be a fertile ground for young entrepreneurs, being spin-offs from academia or start-ups. Michael Porter’s account of localised industrial clusters from his book “The Competitive Advantage of Nations” has been named as one of the most influential theories in recent times. This theory sees geographic proximity as a key role in the formation of industrial clusters as it allows interaction and efficient flows of goods, services, ideas, and skills. This leads to high levels of productivity growth and rapid rates of innovation in both processes and products. Box 5 highlights some successful examples of European clusters.

The start-up companies and SMEs of today can be the industrial backbone of tomorrow.

Stimulating the creation of new ventures and safeguarding the success of small and mid-sized companies should therefore be another pillar of a policy designed to strengthen the innovative capacity of a state or region. Today, most of the capital supporting start-up companies and early-stage businesses comes from venture funds and other private-sector players. However, how easy or difficult it is for start-ups to access growth capital varies greatly across the world. Where such funding is not available, governments should step in and create financial and non-financial instruments that allow inventors and entrepreneurs to apply for business support and start-up grants covering the first critical steps of taking ideas to products and services. The efficacy of this approach has been demonstrated in various regions around the world.

Creating demand: the role of Public Procurement

Demand driven policies can be a strong accelerator for the introduction of new technologies. The mechanism is straightforward: if policies create market demand, they build commercial opportunities for the private sector to pursue. Generally, the level of interest among companies, and hence the intensity of competition, will directly depend on the size of the addressable market. Therefore, scale matters. One way to create or change demand is through regulation, which has often exerted a strong influence as a driver of innovation. Common examples include the healthcare domain, transportation safety, or technologies related to the protection of environmental quality. Preferential treatment of certain technology options is another way to support innovation, as feed-in tariffs for renewable energy have impressively demonstrated. Finally, public procurement can accelerate the introduction of new technologies.

Approximately 13% of OECD countries’ GDP is spent on public procurement, in the EU the number is even higher with 19%. This translates in more than € 400 billion being spent on public procurement in the EU on an annual basis. The newly adopted public procurement directives of January 2014 provide a good basis for procurement based on life cycle cost, environmental aspects and green technology in general. Also, the new directives provide the possibility to divide the work in different smaller lots, thus giving more opportunities to local smaller companies. Public entities could play an important role supporting innovative companies by not looking for the lowest price, but including aspects of innovation, environmental impact, or energy efficiency in their tenders. Areas where this could apply include transportation, healthcare, lighting, smart home/cities, etc. Member States have a unique opportunity to boost innovation when they transpose the directive into national legislation in the coming two years.
Tech City, UK

Tech City is a technology cluster located in Central and East London. It is the third largest technology start up cluster in the world after San Francisco and New York City. Development of the cluster has been encouraged by both local and national government, with the goal of creating a cluster comparable to Silicon Valley in the United States. Cisco, Facebook, Google, Intel and McKinsey & Company are among the companies that have invested in the area. One of the key driving factors for the creation of the cluster is the availability of talent. It is estimated that over 34,000 digital technology companies are based in London providing access to over 28,000 software developers and 10,000 data scientists. City University London, Imperial College London, Loughborough University and University College London are all academic partners in projects based in the cluster.

Nupharo Technological Campus, Czech Republic

Direct current (DC) is an efficient, reliable and preferred technology for the transmission of large amounts of power across long distances. Nupharo is a business incubator and innovation campus dedicated to the promotion of DC and DC technologies, and Smart Energy. Its mission is to develop DC technology into a viable business, reducing energy costs as well as carbon footprint. Nupharo’s concept goes through idea development, pre-production and testing to business know-how and user experience. Both technological start-ups and large multinational companies are offered innovation labs, production development and professional services necessary in the early phases of market entry. The campus is also networked with leading universities and research centers.

British Motor Sport Valley

Virtually the entire British motorsports industry is clustered within a 50-mile radius around Oxford in Southern England. The region has been named “Silicon Valley of Motor Sport” or “Motor Sport Valley”. Approximately three quarters of the world’s single seat racing cars are designed and assembled in the region. The production of equipment is focused on Formula One, Championship Auto Racing, Indy Racing League, as well as Rally cars. Today, almost 4,500 companies associated with motorsport are based in Motor Sport Valley, employing around 40,000 people. That represents around 80% of the world’s high-performance engineers. UK’s Motor Sport Valley is a tremendous success story with continuous growth every year to reach revenues of £9 billion in 2014. The cluster was able to grow over the years due to the high level of R&D investment (25-30% of annual turnover), R&D tax credits and highly skilled employees and exports. With the recent global focus on energy efficient, low carbon solutions, an increasing number of companies reported success from offering race-hardened capability and expertise to adjacent sectors.

Aviation Valley, Poland

Aviation Valley is in the south-eastern part of Poland has evolved into one of the leading locations in Europe for conducting and developing projects associated with aviation. It is a highly specialized aeronautics hub with various manufacturing plants, scientific research centers, as well as educational and training facilities. Once one of the least prosperous regions of Poland, the area now boasts a cluster of more than 100 companies and start-ups providing jobs for over 23,000 engineers, designers and technicians. The Aviation Valley is fully integrated into the global aerospace supply chain, producing gliders, light and ultra-light aircraft, unmanned aircraft, helicopters, aircraft components, as well as chassis and modules for aircraft engines. According to the Polish Information and Foreign Investment agency, every passenger aircraft in the world has at least one part made in Poland.
**Talent Pool**

One issue of concern is the potential skills gap that is emerging in Europe and which has a real risk of inhibiting innovation and growth potential. Even today when unemployment is so high, there are more than two million vacancies in Europe that cannot be filled, many of which are in high tech innovation driven sectors.

If Europe faces a huge skills challenge now, the ageing population means the problem will become even more acute over the next decades. The impact of technology on manufacturing, including the advent of the Industrial Internet, will mean that the skills and talents required are changing. For example, by 2020 a third of jobs in the EU will require tertiary level qualifications.

The number of digital jobs has been growing by three per cent per year during the crisis but the number of new ICT graduates and other skilled ICT workers is shrinking.

Estimates state that by 2015 there will be a shortage of 700,000 qualified technicians and engineers: individuals who would typically be involved in innovation driven sectors. This poses a huge challenge in the move toward the development of high tech and advanced manufacturing sectors. Labour market reform in Europe addressing the urgent need to address the skills and labour gap is necessary. The reforms should allow for greater mobility of talent, changes in immigration rules, pan-EU recognition of qualifications, and investment in attracting people to high tech related skills, including investment in education and in particular in STEM subjects.

**Innovation and Trade**

A fragmented IP framework has greatly added to the cost of innovating and doing business in Europe in the past. The new unitary European Patent will be in place by 2015 (24 Member States have joined) and is to be welcomed. Currently patent registrations are up to 60 times more expensive in Europe than in China.

We see this as another valuable step towards a Single Innovation Market. We need to create a common framework across the EU that promotes and supports innovation at every stage including greater cohesion terms of standards, supports, regulation across the EU 28 to exploit the market potential. The EU has the opportunity to lead the global standards.

**Innovation and TTIP**

IPR will form a major sector of the talks on a Transatlantic Trade and Investment Partnership. IPR intensive industries account for approximately 90% of the EU’s trade with the rest of the world and have a value to the European economy of €4.7 trillion annually. The US and the EU have very strong IP protection and TTIP creates an opportunity for us to work together to ensure that those types of standards are respected around the world as well. This could form the basis for greater cooperation between other countries and regions in the future. GE supports the objectives of TTIP.
V. Concluding Remarks

Five years after the Global Financial Crisis, Europe’s recovery still sputters. It is a mixed picture of performance and recovery.

Some Member States like Germany, the UK, the Nordics and parts of Central and Eastern Europe are in much better shape than others. But overall, the European economy still struggles to boost employment and incomes. Adverse shocks have played a role, but a look at productivity levels and growth rates reveals that in several European countries the problems are structural. This is where innovation can help.

Some of the world’s most innovative countries, sectors and companies are in Europe. The success stories are numerous, from Sweden’s innovation performance to Germany’s manufacturing excellence. But Europe as a whole is not yet an innovation success story. GE’s Global Innovation Barometer has brought to light some of the reasons: Europe underperforms other regions on effective collaboration, the ability to attract private investment, the quality and level of public support for innovation, and the ability to attract, retain and nurture talent. The increasing importance of a structured innovation process and driving greater speed in translating innovation into products are not fully appreciated.

Addressing these shortcomings will require a determined and coordinated effort by both public and private actors. The new wave of innovation fuelled by the Industrial Internet, Advanced Manufacturing and the Global Brain represents a tremendous opportunity for Europe. Through faster innovation it can boost productivity levels, allow European companies to gain a new competitive edge, create new and sustainable job opportunities, increasing growth and raising living standards.

Europe is in many ways especially well positioned to leverage the potential of the Future of Work. This new wave of innovation is based on openness and collaboration, as digital and advanced manufacturing solutions deliver their greatest value by cutting across borders and sectors. And the European Union itself is based on openness and collaboration, and has made the greatest advances in creating common infrastructures and institutions. Full understanding of the benefits of open collaboration is at the very heart of the European project. Innovation is always disruptive, and can fuel fears, especially at times of economic stress. But the innovation wave of the Future of Work represents a tremendous opportunity that Europe is uniquely positioned to embrace and benefit from.
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Imagination at work