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List of abbreviations

ARPA-E – Advanced Research Projects Agency-Energy
BERD – Business Expenditure on R&D
CF – Cohesion Fund
CIP - Competitiveness and Innovation Framework Program
CISE - Computer and Information Science and Engineering
COMPETES - America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science
COSME - EU programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises
COST - European Cooperation in Science and Technology
CRI - Computing Research Infrastructure
DARPA - Defense Advanced Research Projects Agency
DHS – Department of Homeland Security
DHS - Health and Human Services
DOC – Department of Commerce
DoD – Department of Defense
DoE - Department of Energy
DOT – Department of Transportation
EACI - Executive Agency for Competitiveness and Innovation
EASME - Executive Agency for SMEs
ED – Department of Education
EEN – Enterprise Europe Network
EIB – European Investment Bank
EIP - The Entrepreneurship and Innovation Program
EIT – European Institute of Technology
EPA - Environmental Protection Agency
EPSCoR - Experimental Program to Stimulate Competitive Research

ERA - European Research Area
ERC - Engineering Research Centers Program (ERC)
ERC – European Research Council
ERDF - European Regional Development Fund
ESF – European Social Fund
ESIF- European Structural & Investment Funds
FLC - Federal Laboratory Consortium for Technology Transfer
GDP – Gross Domestic Product
GERD - Gross Domestic Expenditure on R&D
HITECH - Health Information Technology for Economic and Clinical Health
I/UCRCs - Industry/University Cooperative Research Centers
I-Corps- Innovation Corps Program
ICT-PSP - The ICT Policy Support Program
IEE - The Intelligent Energy Europe Program
IMI – Internal Market Initiative
IPR – Intellectual Property Rights
IUS 2014 – Innovation Union Scoreboard 2014
JRC – Joint Research Centre
KICs – Knowledge Innovation Communities
MEP - Manufacturing Extension Partnership
NACIE - National Advisory Council on Innovation and Entrepreneurship
NASA - National Aeronautics and Space Administration
NIH - National Institutes of Health
NIST - National Institute of Standards and Technology
NSF - National Science Foundation
NTA - New Transatlantic Agenda

OECD – Organization for Economic Cooperation and Development
OSTP - Office of Science and Technology Policy
PCP – Pre-Commercial Procurement
PCT – Patent Cooperation Treaty
PPI –Procurement of Innovative Solutions
PRIs – Public Research Institutes
R&D – Research and Development
RSFF – Risk Sharing Finance Facility
SAVI – Science Across Virtual Institutes
SBA – Small Business Administration
SBDC - Small Business Development Centers
SBIC - Early Stage Innovation Small Business Investment Company Initiative
SBIR – Small Business Innovation Research
SciSIP - Science and Innovation Policy
SOSP - Science of Science Policy
STAR METRICS - Measuring the Effect of Research on Innovation, Competitiveness and Science
STEM – Science Technology Engineering and Mathematics
STI – Science Technology and Innovation
STTR - Small Business Technology Transfer Program
TBED – Technology based economic development
TEC - Transatlantic Economic Council
TEP - Transatlantic Economic Partnership
TIP – Technology Innovation Program
USDA – Department of Agriculture
VC – Venture Capital
WTO – World Trade Organization

Introduction – Objective of this report

The overall objective of this report is to set the ground for fostering cooperation between the EU and the USA in innovation related matters through the creation of the sound knowledge base tool for collection and sharing of information.

This report is aimed at EU and U.S. researchers and policy makers, but also anyone interested in getting an overview of the current state of play on innovation policy both in the EU and the U.S. will benefit from this report.

The first two sections present briefly the latest developments in terms of the broader EU innovation policy and respective policies and performance in the EU Member States and the U.S. Wherever possible, quantitative and qualitative information is provided about the programs in order to highlight their impact. The data are based on official reports provided to Congress evaluating performance and implementation The third section presents the S&T cooperation patterns and agreements between EU and U.S., while the fourth section presents a brief comparison of the EU and U.S. innovation policy systems and innovation performance indicators, highlighting the key findings of previous sections. In this section, there is a brief set of policy recommendations for further improving the S&T and innovation cooperation between the EU and the U.S. The document is closing with the conclusions' section.

Finally, the annexes (presented in a separate document) include tables with information concerning relevant U.S. and EU policy documents and evaluation reports, policy measures and funding schemes, technology platforms and key organizations.

Executive Summary

This report is based on literature review and the inputs provided by U.S. partners on innovation and technological policies and strategies, relevant policy and strategic documents and evaluations, funding schemes as well as key relevant organizations.

The report presents an overview of the EU and U.S. innovation policy systems including information on policies undertaken to overcome the latest global financial downturn but also for further promoting innovation and broader S&T policies. The report mainly focuses on relevant innovation support programs and initiatives but also provides information on key strategies, official documents, reports and communications that indicate the overall objectives that have been set. There is a presentation of the EU-U.S. S&T collaboration history and patterns indicating the relevant S&T agreements between U.S. and the EU but also the U.S. and the individual Member States (MS).

Main findings from the presentation of the EU & U.S. Innovation Policy Systems

The EU and the USA are two of the global innovation leaders along with Japan and South Korea.

According to the Innovation Union Scoreboard 2014, the global position of Europe is quite strong, with a large and stable share (28%) of income created in global manufacturing value chains. At the same time, the U.S. and Japan in 2013 saw their shares of income shrinking given the global economic downturn. Still, the U.S. is a country with excellent higher education institutions, a strong industry base, a large and integrated marketplace, and efficient capital and equity markets. The U.S. lead in shares of Gross Domestic Expenditure on R&D (GERD) (41%), triadic patent families (29%) and scientific publications (31%) in the latest OECD reports. Additionally, the U.S. hosts nearly a third of the world's largest corporate R&D investors.

The European policies on innovation and the respective priorities at EU level are reflected in the key strategic documents setting the main objectives to be achieved, i.e. the Lisbon Strategy (2005) and the Europe 2020 Strategy with its respective flagship initiatives. The key innovation initiative within this strategy is the Innovation Union, which comprises the EU's strategy to create an innovation-friendly environment that will foster new ideas and facilitate their "translation" into products and services that will bring growth and jobs in Europe.

The US innovation system has multiple policymaking points, including the Executive Office of the President and Congress, that must come together to determine the programs and annual funding for science and technology. Innovation policy is administered in the federal agencies, with the US Department of Commerce being particularly important in recent years. Most R&D initiatives in the US are driven by federal agencies such as Department of Defense, Department of Energy, or National Institutes of Health. In fact the estimated distribution of R&D by agency in FY 2014 by budget authority shows that about 48.7% is allocated to the Department of Defense, 22.7% to the National Institutes of Health and 8.4% to the Office of Science in the Department of Energy. NASA receives also about 8.5%[1]

Innovation also receives big focus and attention at the state level, as state governments are closer to the needs of business sectors, which comprise the regional economies. Innovation performance is mostly undertaken by the private sector (i.e. industry) which is diversified, including a variety of players ranging from large multinationals to knowledge-based start-ups. This reflects in part a belief that innovation is best left to the market and that the role of government, to the extent there is one, is to support "factor inputs" such as knowledge creation and education. As indicated in the latest TrendChart mini country report for the U.S. (2013), "the U.S. innovation system also includes private non-profit policymaking, advocacy, research, and technology transfer companies. Venture and risk

[1]Federal R&D Budget Trends: A Short Summary (2015). http://www.aaas.org/news/primer-recent-trends-federal-rd-budgets

capital organizations are important sources for financing. Universities serve not only as sources of innovative ideas, but also facilitate and administer the innovation process".

At the EU level, the key innovation priorities set out concern the creation of growth and jobs, especially for the young people, getting the economy back on track, providing the necessary support for increasing competitiveness of companies (access to global markets), addressing ageing population related challenges, fighting global warming and improving smart and green transport. All these priorities are promoted through the Horizon 2020 Program, which is the new Framework Program for Research and Innovation Development of the European Commission for the period 2014-2020. In the U.S., innovation policy priorities have shifted along with the latest economic changes following the crisis. As mentioned in the latest mini TrendChart U.S. country report "in 2009, innovation policy priorities were part of a broad-based investment environment aimed to stimulate recovery from the economic crisis; since 2011, they exist in an environment that promotes greater attention to reducing the federal deficit and "rebalancing" the economy, while also making selective investments to incentivize job growth and innovation"[2]. Nonetheless, "the administration has instituted several new multi-agency regional innovation cluster programs to enhance the innovation ecosystem of localized targeted industry sectors"[3]

EU innovation policy effectiveness and the actual status of the Innovation Union set out objectives and respective commitments are monitored and reviewed both by the Innovation Union Scoreboard and by the "annual status report". Efficiency of measures and initiatives already in place are measured while new targets and objectives for achieving the actual goals are proposed. In the U.S. on the other hand, the most recent assessment of innovation policy was back in 2010 and was presented in the form of a report entitled "Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5". The main conclusion of the report was that the U.S. research and innovation position has declined in comparison to other countries.

EU's policies, especially research and innovation related programs are to a large extent open to third countries and cooperation with regions and countries across the world is considered to be key for achieving the Europe 2020 strategy objectives. This is clearly articulated in the Commission Communication of 2012 "Enhancing and focusing EU international cooperation in research and innovation: A strategic approach".

For the U.S., at the level of individual policy measures, several allow for third country participation. Nearly one-quarter of the measures provide funds to other countries as long as the leading organization is a U.S.-based university or other research institution. About 40% of the measures do not provide funding to non-U.S. institutions. The remaining 40% have specific pre-requisites for allowing receipt of U.S. funds by third countries.

Main findings concerning the S&T cooperation between EU& the U.S.

Europe has traditionally been an important S&T and innovation partner for the U.S. and there is a long record of research linkages between the two sides. Researcher exchange between the U.S. and Europe has always been a key cooperative research activity. The EU's Marie Curie Researchers' Exchange Program is one of the most appreciated ones in the U.S. and proves that exchanges of researchers still dominate the relationship between the EU and the U.S.

In the area of science and technology, the EU and U.S. concluded a Science and Technology (S&T) Co-operation Agreement in 1999, which was renewed in 2004, 2009, and in 2014[4]. Since then, joint

[2] INNO Policy TrendChart: Mini Country Report/United States of America: http://ec.europa.eu/enterprise/policies/innovation/files/countryreports/usa_en.pdf

[3] INNO Policy TrendChart: Mini Country Report/United States of America: http://ec.europa.eu/enterprise/policies/innovation/files/countryreports/usa_en.pdf

[4] Entered into force June 13, 2014 effected by Exchange of Notes at Brussels and Washington on April 28 and June 12, 2014. http://www.state.gov/documents/organization/229961.pdf

research activities are undertaken in a number of fields such as biotechnology, environment, materials science (including nanotechnology) and non-nuclear and renewable energy.

"S&T co-operation between Europe and the U.S. is based on a variety of instruments using a combination of unilateral, bilateral and multi-lateral approaches", as stated in the EC report "Evaluation of the EU-U.S. Agreements on S&T".

Main findings concerning EU& U.S. innovation performance

According to the Union Innovation Scoreboard 2014, the United States has been consistently more innovative than the EU but the performance lead is continuously decreasing. Between 2006 and 2009, the U.S. innovation index was about 30% higher than that of the EU, but since 2009 the U.S. lead has been progressively declining to 17% in 2013. Between 2008 - when the lead was at its peak - and 2013 the U.S. performance lead has been reduced by half from 32% to 17%.

A much higher share of the U.S. population has completed tertiary education, 42% in the U.S. compared to 28.5% in the EU in absolute terms creating a performance lead of the U.S. over the EU of almost 50%. The number of International co-publications and the quality of U.S. scientific publications are also much higher and the scientific collaboration between the private and public sector is almost double that in the EU. U.S. businesses' expenditure on R&D is about 40% more than the EU respective expenditure (1.82% of GDP in 2011 compared to 1.29% in the EU). The U.S. is also more successful in commercializing new technologies with 17% more License and patent revenues compared to the EU. The U.S. has relative weaknesses in PCT patent application and the contribution of medium-high-tech product exports to the trade balance.

Suggestions to policy makers for enhancing EU-U.S. innovation collaboration

The final section includes a large set of recommendations for further improving the EU-U.S. S&T cooperation, for consideration by the policy makers. The recommendations concern:

- EU-U.S. S&T cooperation agreements
- Cooperation under the EU &U.S. funding programs
- Reciprocity Principle
- EEN – U.S.-EU Match role
- Internal Market Information (IMI) System

In order to provide a short overview some of the recommendations are provided below

- The EU-U.S. S&T cooperation agreement is very important for facilitating the regular S&T policy dialogue between the European Community and the Government of the United States aiming to enhance the EU-U.S. S&T cooperation and the exchange of experience and good practice in the area of S&T policy. It could be useful to have an extension of the areas and forms of cooperation between the EU and the U.S. – based on an open dialogue involving all key stakeholders who could propose ideas, further thematic areas and also types of actions that could be included in an extended S&T cooperation agreement.
- The cooperative definition of standards is a field of potential U.S. / EU innovation cooperation. The lack of uniform international standards can result in limiting the economic opportunities of companies with superior technologies because a multiplicity of standards can effectively result in a multiplicity of fragmented markets, the perspective of which often hinders investment into innovative technologies.
- The main form of EU-U.S. S&T cooperation is notably the European Commission's Framework Program for Research and Technology (now H2020). It might be worthwhile considering the creation of more targeted programs or actions, directly focusing on supporting the EU and

U.S. S&T Cooperation areas. These programs could focus on limiting the administrative or legal barriers for both EU and U.S. parties who wish to cooperate.

- As the new framework program for Research and Development has been launched earlier in 2014 (i.e. Horizon 2020), there is a need to enhance the visibility of the Program scope in the U.S. and thus further promote EU-U.S. S&T cooperation.
- To enhance U.S. participation in European Programs and vice versa, it would be useful to organize training sessions for interested participants, where the programs will be explained from the application phase (how to write your proposal, how to find the right partner, etc.) to the implementation and reporting phase (financial and administrative rules, how to write the report, etc.)
- Both the EU and the U.S. should set specific and measurable targets in terms of each other's participation in their S&T funded programs. The targets and cooperation models should be relevant to the number of participating organizations or individual researchers, the type of different programs selected, the specific results achieved, etc.
- In the U.S. around 20% of the measures address social innovation goals such as society-driven challenges, capability development to foster greater equality in receipt of federal R&D funds between the states, and greater understanding of informal and formal societal environments for encouraging learning. In a future perspective, the EU could learn a lot from the U.S. in terms of best practices in the field of social innovation for example by looking in measures as the Science of Science and Innovation Policy (SciSIP) of the NSF.
- The Marie Curie actions are the strongest scheme in the EU-U.S. S&T cooperation. In the period 2007-2017, there were 1366 American researchers funded in Marie Curie Actions and 929 American organizations participating in the scheme. Overall, funding allocated during the period was EUR 0,626 million.[5] There should be more focus on such schemes for attracting more U.S. researchers to Europe.
- A real need to **mapping the help structures** was identified during the BILAT 2.0 EU-US Innovation Conference *(both transatlantic structures and national structures aiming at transatlantic exchanges/putting transatlantic businesses/organizations in contact)* . There is a need to review these structures and identify the gaps. Important are mapping bodies than can help connecting academic research/ research institutions with businesses on both side of the Atlantic, and move innovation to the market.

This report does not claim to be addressing all challenges that need to be considered for improving the EU-U.S. S&T and innovation cooperation. The recommendations are only based on the literature review and on discussion that have been undertaken during the BILAT 2.0 EU-U.S. Innovation Conference on14-15 January 2015 in Brussels.

[5] http://ec.europa.eu/research/mariecurieactions/funded-projects/statistics/index_en.htm

1 EU: Innovation Policy overview

The European Commission Communication to the European Parliament, the European Economic and Social Committee and the Committee of the Regions, on the Innovation Union Flagship Initiative of the Europe 2020 strategy, published on the 6th of October 2010, clearly stated that "Europe doesn't have a shortage of potential." In fact, the communication points out, that "*Europe has world leading researchers, entrepreneurs and companies and unique strengths in its values, traditions, creativity and diversity*".

Although there is engagement both by the entrepreneurial world and the civil society towards creating the largest home market in the world, still, Europe could perform better.

"The global position of Europe is still quite strong. The EU is one of the world's best-performers in producing high-quality science and innovative products. It still captures the largest and a stable share (28%) of income generated in global manufacturing value chains while the U.S. and Japan saw their shares shrinking. Since 2008, the EU has improved its innovation performance and it closed almost half of the innovation gap with the U.S. and Japan. The EU is still keeping its strong innovation lead over Brazil, India, Russia, and China, although the latter is most markedly catching up. In addition, South Korea has almost tripled its innovation lead over the EU since 2008 and has joined the U.S. as an innovation leader". [6,7]

The Innovation Union Scoreboard 2014 report outlines that EU performance has been increasing at an average annual rate of 1.7% between 2006 and 2013. Still, it is noteworthy that some dimensions and indicators are stronger than others. More specifically open, excellent and attractive research systems related indicators have been very strong (i.e. 4.5%). This can be attributed to the high growth in both the international scientific co-publications (6.0%) and the non-EU doctorate students (6.3%). The EU innovation system appears to be increasingly more networked, both between the Member States and on a global scale.

To fully capture the potential of research and innovation as sources of renewed growth, the following are crucial elements[8]:

- Member States need to prioritize growth enhancing expenditure, notably on R&I.
- Investments need to go hand in hand with reforms to increase the quality, efficiency and impacts of public R&I spending, including by leveraging business investment in R&I.
- Member States should focus on three main axes of reform, relating to the quality of strategy development and the policy making process; the quality of programs, focusing of resources and funding mechanisms; and the quality of R&I performing institutions.
- Strengthening the broader innovation eco-system and putting in place the right framework conditions to stimulate Europe's companies to innovate is crucial

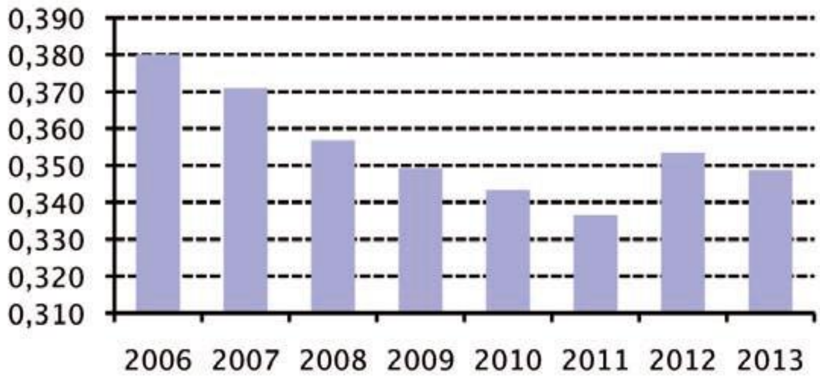
1.1 EU Member States Innovation Performance[9]

The on-going economic crisis has exposed a number of structural weaknesses in Europe's innovation performance. Up until 2011, differences in innovation performance have become smaller with a steady rate of convergence. However, in 2012 the convergence process retreated and differences in innovation performance at country level increased to the respective levels of 2008 and 2009. The

[6] http://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication_en.pdf
[7] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (State of the Innovation Union 2012 - Accelerating change), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2013:0149:FIN:en:PDF
[8] http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2013/research-and-innovation-as-sources-of-renewed-growth-com-2014-339-final.pdf
[9] Innovation Union Scoreboard 2014

results for this year show that **innovation performance among Member States is converging** although the level of convergence went back to the level of 2009. Therefore, differences in the innovation performance as noted in 2013 are more distinct differences in the innovation performance rates as noted in 2013 are therefore more distinct than those that noted before 2008.[10]

Figure 1: Convergence in EU Member States' innovation performance



The bars show the degree of sigma- convergence[11]. Lower (higher) degrees of sigma-convergence reveal higher (lower) convergence.

Source: Innovation Union Scoreboard, pg.26

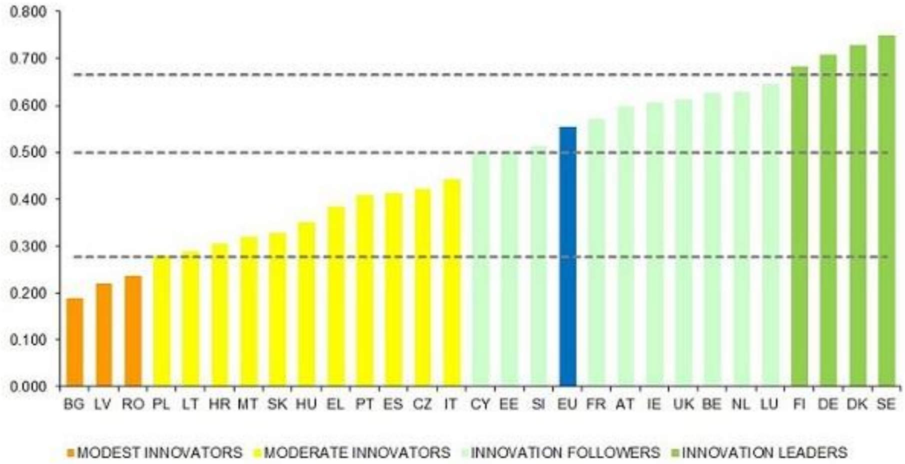
Based on their average innovation performance, the Member States are categorized into four different performance groups:

- "**Innovation Leaders**" with innovation performance well above that of the EU average: Denmark (DK), Finland (FI), Germany (DE) and Sweden (SE).
- "**Innovation followers**" with innovation performance above or close to that of the EU average: Austria (AT), Belgium (BE), Cyprus (CY), Estonia (EE), France (FR), Ireland (IE), Luxembourg (LU), Netherlands (NL), Slovenia (SI) and the United Kingdom (UK).
- "**Moderate innovators":** Croatia (HR), Czech Republic (CZ), Greece (EL), Hungary (HU), Italy (IT), Lithuania (LT), Malta (MT), Poland (PL), Portugal (PT), Slovakia (SK) and Spain (ES) is below that of the EU average.
- "**Modest innovators**" with innovation performance well below that of the EU average: Bulgaria (BG), Latvia (LV) and Romania (RO).

[10] Ibid.

[11] Sigma convergence: When the dispersion of real per capita income across a group of economies / countries falls over time, there is sigma (σ)-convergence.

Figure 2: Member States Innovation Performance[12]



Overall, the EU annual average growth rate **of innovation performance reached 1.7%** for the eight-year period 2006-2013 considered for the analysis, with all Member States improving their innovation performance. Portugal, Estonia and Latvia are the **innovation growth leaders**. The lowest innovation growth rates were recorded in Sweden, the UK and Croatia. The reasoning behind the low growth rates for Sweden and UK is that they have already a very high innovation performance, thus there is not much room for improvement. For Croatia on the other hand, being amongst the "moderate innovators' group", the low performance may have to do with the current economic crisis and the difficulties faced within the country.

1.2 EU Innovation Policy System[13]

There is no such thing as a centralized EU innovation policy system followed up by all EU Member States. The Member States' national governments follow up on the overall targets and objectives set out at EU policy level and try to implement the best possible policy mixes to achieve the respective goals at national level.

Early in the 2000s, the Lisbon Strategy marked a turn towards more attention for innovation within the EU. As it became clear that Europe was falling behind the United States and some other countries in Asia in terms of research and innovation, the need for more coordination at the European level became clear. The Lisbon Strategy was an attempt to reverse this trend. It was officially adopted in March 2000 and it aimed for Europe to become, by 2010, *"the most competitive and dynamic knowledge-based economy in the world, capable of sustainable growth with more and better jobs and greater social cohesion".*

Since 2000 the Lisbon agenda was put in place through the implementation of several policy initiatives. Despite these efforts, in 2005, the European Commission assessed the results and considered that there was more to be done, thus proposed to re-kick the Lisbon Strategy. The new Lisbon Strategy had a longer-term focus, spanning up to 2020. The most "famous" Lisbon target was that of increasing the spending on research and development to 3% of GDP in all EU member states.

The new strategy was articulated into three key priorities:

1. Making Europe a more attractive place to invest and work
2. Make knowledge and innovation the beating heart of European growth
3. Shape the policies allowing businesses to create more and better jobs.

[12] Innovation Union Scoreboard 2014
[13] INNO Policy TrendChart: Mini Country Report/United States of America: http://ec.europa.eu/enterprise/policies/innovation/files/countryreports/usa_en.pdf

Innovation is identified as having a key role in achieving sustainable economic growth and with the adoption of the Lisbon agenda, the view on knowledge and innovation has become broader focusing more on innovation as a socio-economic process rather than a technological process. However, according to some authors, the linear perspective of innovation is still dominant in much of the practical implementation of innovation policy within the EU.

Since 2010, the Europe 2020 strategy was launched, aiming to help overcome the crisis but also to address the shortcomings of the European growth model and create the conditions for smart, sustainable and inclusive growth.

Within the Europe 2020 strategy, five overarching objectives have been set for the EU to achieve by the end of 2020. These cover:

- Employment (75% of the 20-64 year-olds to be employed)
- Research and development (3% of the EU's GDP to be invested in R&D)
- Climate/energy sustainability (greenhouse gas emissions 20% (or even 30%, if the conditions are right) lower than 1990; 20% of energy from renewable; 20% increase in energy efficiency)
- Education (reducing rates of early school leaving below 10%; at least 40% of 30-34-year-olds completing third level education)
- Fighting poverty and social exclusion (at least 20 million fewer people in or at risk of poverty and social exclusion)

The key innovation initiative within this strategy is the Innovation Union, one of the flagship initiatives, practically comprising the EU’s strategy to create an innovation-friendly environment that will foster new ideas and facilitate their “translation” into products and services that will bring growth and jobs in Europe.

The Innovation Union contains 34 commitments, among which the strategic use of public procurement budgets to finance innovation, a comprehensive innovation scoreboard based on 25 indicators (i.e. Innovation Union Scoreboard), and a European knowledge market for patents and licensing. Furthermore, it includes measures to reinforce successful existing initiatives like the Risk Sharing Finance Facility that was launched in cooperation with the European Investment Bank (EIB), which supports investment in high-risk research, technological development and demonstration projects through loans and guarantees. The Risk Sharing Finance Facility is an attempt to boost the investments in innovations. The idea was that by reinforcing the financing capacity of EIB in the area of research, the efforts of a large number of European banks and financial institutions would be mobilized into research and innovation, hence increasing the amount of private investment and funding.

Other key points in the Innovation Union set-up concern the measures to accelerate efforts for building the European Research Area (ERA). “The ERA is a system of scientific research programs integrating the resources of the EU. The structure has been concentrated on multi-national co-operation and exchanges across borders in the fields of medical, environmental, industrial and socio-economic research. A central objective of the ERA is therefore to establish the “fifth freedom”: the freedom of movement of knowledge as the equivalent for research and innovation of the common market. Increased mobility of researchers and knowledge workers and deepened multilateral co-operation among research institutions also belong to the central goals of the ERA”[14].

To help achieve these objectives, a European Institute of Innovation and Technology (EIT) was created. “EIT is an autonomous EU body bringing together the ‘knowledge triangle elements’: higher education, research and business to stimulate innovation by connecting them through their Knowledge and Innovation Communities (KICs). The EIT's flexibility aims at making it attractive to the business sector. A contribution of 308.7 million euro for 2008-2013 was provided to the EIT from the

[14] Directorate-General for Research (2007), “The European Research Area: New Perspectives”, Green Paper, COM (2007) 161.

EU budget".[15] It should be noticed that the contribution to the EIT has been drastically increased for the period 2014-2020: 2.7 billion euros has been set up in the Horizon 2020 program (see also section 1.2.2.2. below)

The 2012 Communication on "A Reinforced European Research Area Partnership for Excellence and Growth"[16] identified five priorities for action:

- more effective national research systems,
- optimal transnational co-operation and competition,
- an open labor market for researchers,
- gender equality and gender mainstreaming in research, and
- optimal circulation, access to and transfer of scientific knowledge including via digital ERA.

The ERA principles are fully integrated in the Europe 2020 Innovation Union flagship initiative to foster Growth and Jobs. In fact, completing the ERA will bring efficiency, quality and impact gains and new opportunities for all Member States. It is an opportunity for less well-performing Member States to take responsibility for reforming their research systems, driving a process of smart specialization, and helping to close the innovation divide. Horizon 2020 and the Structural Funds support these goals.

1.2.1 Key Innovation priorities

The key innovation priorities as articulated within the Innovation Union strategic documents are the following:

- To create job opportunities for all and especially for young people
- To get the economy back on track
- To help increase the competitiveness of companies, allowing them to become players in a global market environment
- To address the challenges concerning the ageing population
- To secure resources like food and energy (fuel)
- To fight global warming
- To improve smart and green transport

These priorities are addressed through a number of initiatives under the new European Framework Program, entitled Horizon 2020 for the seven year period 2014-2020. Horizon 2020 is the new financial instrument implementing the Innovation Union strategy.

Horizon 2020 is supported by Europe's leaders and the Members of the European Parliament as the means to drive economic growth and create jobs.

Horizon 2020 places emphasis on excellent science, industrial leadership and aims to tackle societal challenges through joint actions for research and innovation. The goal is to ensure that Europe will continue to produce world-class science by removing barriers to innovation and facilitating the collaboration between public and private sectors in creating and delivering innovation outcomes.

[15] http://eit.europa.eu/

[16] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "A Reinforced European Research Area Partnership for Excellence and Growth" COM(2012)392 final http://ec.europa.eu/euraxess/pdf/research_policies/era-communication_en.pdf

1.2.2 Latest policy measures

1.2.2.1 Funding mechanisms and Policy measures 2007-2013

There are a number of EU research and innovation funding mechanisms that have been put in place in the last years. For the programming period of 2007-2013, the major programs were the Seventh Framework Program, the Competitiveness and Innovation Framework Program (CIP) and the Structural Funds. The fundamental difference between Cohesion Policy financed by the Structural Funds and FP7 and CIP is that its management and programming is decentralized, i.e. the implementation and allocation of funds to projects is not handled by the European Commission directly; instead, they are delegated to national/regional managing authorities. In the same time important policy measures that have been initiated in this period include the smart specialization strategy and cluster policies which can support the internationalization of young innovative firms. Policies supporting innovation and internationalization should link up as since exporting and innovation are mutually reinforcing strategies that result in higher export shares, turnover and employment growth at the firm level. In this respect also the European Cluster Observatory, presented below, has been set up.

FP7 (2007-2013)

"The Seventh Framework Program (FP7) was operational throughout the period 2007-2013 and had a budget of 53.3 billion euro aiming to support research, technological development and demonstration activities across the EU. With this budget, FP7 was in fact the largest research program in the world"[17]. Its activities were implemented under four major categories: 1) Cooperation, 2) Ideas, 3) People and 4) Capacities; FP7 also supported the Euratom Framework program for research on nuclear energy and the Joint Research Centre (JRC) that is the European Commission's "in house research centre divided into seven separate research institutes located in five different countries. On 23 October 2014, the European Commission launched an external evaluation of the Seventh Framework Program which is expected to be completed by the end of 2015.

CIP (2007-2013)

"The Competitiveness and Innovation Framework Program (CIP) had a budget of 3.6 billion euro and its main aim was to encourage the competitiveness of European industry, with SMEs as its main target. It promoted access to finance and supported the development of better innovation support services and policies. It funded trans-national business and innovation support services. It addressed clusters, public procurement and non-technological barriers to innovation. It offered help in developing the information society by stimulating take-up and use of ICT and promoted the increased use of renewable energies and energy efficiency".

The CIP was composed of three specific programs which had their own specific objectives:

- The Entrepreneurship and Innovation Program (EIP)
- The ICT Policy Support Program (ICT-PSP)
- The Intelligent Energy Europe Program (IEE)

Regarding the impact of CIP based on the CIP Performance Report of October 2013[18] confirms that the CIP as a whole has become a major vehicle for promoting innovation, The CIP final evaluation[19] concludes that the CIP as a whole has become a major vehicle for promoting innovation, thereby contributing to the competitiveness of the European economy.

[17] http://ec.europa.eu/research/fp7/
[18] http://ec.europa.eu/cip/files/cip/cip-performance-report-october-2013_en.pdf
[19] http://ec.europa.eu/cip/files/cip/cip_final_evaluation_final_report_en.pdf.

Some of the main achievements within the Entrepreneurship and Innovation Program are set out below:

Since 2007, the Financial Instruments have:

- assisted more than 240.000 companies;
- helped to mobilize over €13 billion of loans and €2.3 billion of venture capital for SMEs across Europe;

The Enterprise Europe Network, which brings together business support organizations from more than 50 countries, has:

- been in contact with more than 2 million SMEs each year. More than half of the SMEs which used its services confirmed that they had accessed new markets or developed new products.
- helped businesses find business partners. On average, the impact on turnover of these partnerships was 220000 EUR per company. The total impact on sales growth is estimated at €625 million. Between 2008 and 2012, more than 4 400 jobs have been created by firms under partnership agreements.

Framework conditions for businesses were improved through the exchange of best practice for example by:

- simplifying the administrative procedures linked to starting up a small business: In 2012 the average time and cost of starting up a private limited company has been reduced from 12 days and €485 in 2007 to 5.4 days and €372 in 2012.

Innovation was promoted by, for example:

- supporting the market application of more than 200 eco-innovation projects in various sectors such as recycling, green business, the food and drinks sector, water and the buildings sector. Approximately 65% of participants were SMEs. The projects also have a significant leverage effect, as participants are required to provide 50 % of the cofunding.

Policy-development was supported through analysis and benchmarking, policy monitoring,

- workshops and exchanges of best practices by means of, for example the European the European Innovation Scoreboard, EU SME annual reports and the SBA country factsheets.

The Information and Communication Technology Policy Support Program (ICT PSP) has improved interaction and cooperation between public administrations, citizens and businesses, through large scale pilot projects by:

- initiating coordinated efforts for government interaction and cooperation, e.g. for common eID (STORK), common tools and processes for electronic procurement (PEPPOL), creating a common structure and portal for access to cultural content (Europeana), justice communication via Online data exchange (e-CODEX), points of single contact for businesses (SPOCS).

The Intelligent Energy — Europe II Program (IEE II) has created favourable market conditions by helping to remove market barriers and introduce and further develop new market tools:

- The EU Directives on renewable energy, co-generation, energy services, eco-design, labelling and the energy performance of buildings have all been supported by studies, and exchanges of practices on implementation issues have been facilitated.
- Furthermore several projects fed in the discussions that led to the adoption of the new Energy Efficiency Directive in October 2012, and the implementation of the latter will be facilitated through an IEE-funded Concerted Action involving all national implementing bodies. This action is complementary to two other Concerted Actions also supported by IEE and which address respectively the Energy Performance in Buildings and the Renewable Energy Directives.

Structural Funds (2007 - 2013)

"The structural funds are part of the European Cohesion Policy that aims to reinforce economic and social cohesion in Europe by redressing some of the main regional imbalances through support for the development and structural adjustment of regional economies. One of the programs' focal points is the need to strengthen competitiveness and innovation. The three main structural funds under which research and innovation activities could be supported during the 2007-2013 period were":

1. The European Regional Development Fund (ERDF) aimed to strengthen competitiveness by helping regions to anticipate and promote economic change through innovation and the promotion of the knowledge society, entrepreneurship, the protection of the environment, and the improvement of their accessibility. It also supported cross-border co-operation through joint local and regional initiatives, trans-national co-operation aiming at integrated territorial development, and interregional co-operation and exchange of experience.
2. The Cohesion Fund (CF) was intended for the least-developed Member States and regions, i.e. Member States who's GNI (Gross National Income) is lower than 90% of the EU average could benefit from the Cohesion Fund. Assistance from the Cohesion Fund was given to actions in the areas of trans-European transport networks and the environment within the priorities assigned to Community environmental protection policy (including energy, rail, sea transport and air traffic). Through the Cohesion Policy, about 86 billion euro (almost 25% of the total Structural Funds budget) was allocated to enhancing the capacity of regional economies to change and innovate. This investment focused on four key elements: R&D and innovation, entrepreneurship, ICT and human capital development.
3. The European Social Fund (ESF) was for strengthening competitiveness and employment by helping member states and regions to adapt the workforce, their enterprises and entrepreneurs with a view to improving the anticipation and positive management of economic change, in particular by promoting lifelong learning and increased investment in human resources, the development of qualifications and competences, the dissemination of information and communication technologies, e-learning, eco-friendly technologies as well as the promotion of innovation and business start-ups.

Smart specialization strategy[20] (2007-2013)

Smart specialization is a new innovation policy concept designed to promote the efficient and effective use of public investment in research. The goal is to boost regional innovation in order to achieve economic growth and prosperity, by enabling regions to focus on their strengths. To push forward the smart specialisation concept, the Commission announced the setting up of the S³Platform in a 2010 Communication entitled 'Regional Policy contributing to smart growth in Europe 2020'[21]. This platform aims to assist regions and Member States in developing, implementing and reviewing regional smart specialisation strategies, and help regions identify high-value added activities which offer the best chances of strengthening their competitiveness.

The underlying rational behind Smart Specialization is that by concentrating knowledge resources and linking them to a limited number of priority economic activities, countries and regions can become and remain competitive in the global economy[22]. Specialization allows regions to take advantage of important drivers of productivity such as scale, scope and spillovers in knowledge production and use. A smart specialisation strategy needs to be built on a sound analysis of regional assets and technology. It should also include an analysis of potential partners in other regions and avoid unnecessary duplication. Smart specialisation needs to be based on a strong partnership

[20] http://ec.europa.eu/research/regions/index_en.cfm?pg=smart_specialisation

[21] http://ec.europa.eu/regional_policy/sources/docoffic/official/communic/smart_growth/comm2010_553_en.pdf

[22] Guide to Research and Innovation Strategies for Smart Specialisation (RIS 3) http://s3platform.jrc.ec.europa.eu/en/c/document_library/get_file?uuid=e50397e3-f2b1-4086-8608-7b86e69e8553

between businesses, public entities and knowledge institutions – such partnerships are recognised as essential for success.

Cluster policies (2007-2013)

Clusters are groups of specialized enterprises – often SMEs – and other related supporting actors that cooperate closely together in a particular location. In working together these SMEs can be more innovative, create more jobs and register more international trademarks and patents than they would alone. Additionally, "clusters operate together in regional markets. 38% of European jobs are based in such regional strongholds and SME participation in clusters leads to more innovation and growth"[23].

There are about 2000 statistical clusters in Europe, of which 150 are considered to be world-class in terms of employment, size, focus and specialization. According to the European Cluster Excellence Scoreboard[24], for a number of selected emerging industries and regions in the period 2010-2013, 33.3 % of firms in clusters showed employment growth superior to 10%, as opposed to only 18.2% of firms outside clusters.

The EU Cluster policies complement the Smart Specialization strategy. In order to have the information on one place a dedicated EU cluster portal has been created (http://ec.europa.eu/enterprise/initiatives/cluster/index_en.htm). This portal provides tools and information on key European initiatives, actions and events for clusters and their SMEs with the aim of creating more world-class clusters across the EU.

Key European Initiatives regarding clusters include:

- The European Cluster Observatory[25], providing information, mapping tools and analysis of EU clusters and cluster policy. Also informs about events and activities for clusters.
- Cluster Excellence[26], supporting benchmarking and training tools for cluster organizations.
- Cluster Internationalization[27], enabling EU clusters to profile themselves, exchange experience and search for partners for cooperation within and beyond the EU.

1.2.2.2 Funding mechanisms and Policy measures 2014-2020

The 2014 State of the Innovation Union report shows growing momentum around innovation, within the context of the review of the Europe 2020 strategy. Major results include more innovation friendly business environment through the Unitary Patent and the Venture Capital passport. Union support for R&I has been fundamentally reformed in a single, integrated and simplified program, Horizon 2020, with clear, measurable objectives focusing on scientific excellence, industrial leadership and societal challenge[28].

Horizon 2020 (2014 – 2020)

Horizon 2020 is a program open for all, with a simple structure that reduces bureaucracy and time needed for preparing proposals. Thus, participants can focus on what is really important: the research and innovation ideas and their realization. This approach aims to ensure that new projects

[23] http://ec.europa.eu/enterprise/initiatives/cluster/index_en.htm
[24] http://www.emergingindustries.eu/Upload/CMS/Docs/ECES_Pilot.pdf
[25] http://ec.europa.eu/enterprise/initiatives/cluster/observatory/index_en.htm
[26] http://ec.europa.eu/enterprise/initiatives/cluster/excellence/index_en.htm
[27] http://ec.europa.eu/enterprise/initiatives/cluster/internationalisation/index_en.htm
[28] COM (2014) 339 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: "Research and innovation as sources of renewed growth" http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2013/research-and-innovation-as-sources-of-renewed-growth-com-2014-339-final.pdf

get off the ground quickly – and achieve results as quickly as possible. The minimum conditions for participation are that (a) at least three legal entities shall participate in an action; (b) three legal entities shall each be established in a different Member State or associated country; and (c) the three legal entities referred to in point (b) shall be independent of each other within the meaning of Article 8[29].

The EU Framework Program for Research and Innovation is complemented by further measures to complete and further develop the European Research Area. These measures aim to break down barriers and to allow to create a genuine single market for knowledge, research and innovation. Similarly to the 7th Framework Program for Innovation and Research the Horizon 2020 Program is based on specific pillars.

These are:

Excellent Science (EUR 24 441 mil): Activities under this Pillar aim to reinforce and extend the excellence of the Union's science base and to consolidate the European Research Area in order to make the Union's research and innovation system more competitive on a global scale. The specific objectives under this pillar include:

1. The European Research Council (ERC) (EUR 13 095 million) will provide attractive and flexible funding to enable talented and creative individual researchers and their teams to pursue the most promising avenues at the frontier of science, on the basis of Union-wide competition.
2. Future and emerging technologies (EUR 2 696 million) will support collaborative research in order to extend Europe's capacity for advanced and paradigm-changing innovation. They will foster scientific collaboration across disciplines on radically new, high-risk ideas and accelerate development of the most promising emerging areas of science and technology as well as the Union-wide structuring of the corresponding scientific communities.
3. Marie Skłodowska-Curie Actions (EUR 6 162 million) will provide excellent and innovative research training as well as attractive career and knowledge-exchange opportunities through cross-border and cross-sector mobility of researchers to best prepare them to face current and future societal challenges.
4. Research infrastructure (including e-infrastructures) (EUR 2 488 million) will develop European research infrastructure for 2020 and beyond, foster their innovation potential and human capital, and complement this with the related Union policy and international cooperation.

These objectives form a balanced set of activities, which in combination with activities at national and regional levels, span the breadth of Europe's needs regarding advanced science and technology. Bringing them together in a single program will enable them to operate with greater coherence, in a rationalized, simplified and more focused way, while maintaining the continuity, which is vital to sustain their effectiveness.

The activities are inherently forward-looking, building skills in the long term, focusing on the next generation of science, technology, researchers and innovations and providing support for emerging talent from across the whole of the Union and associated countries, as well as worldwide. In view of their science-driven nature and largely 'bottom-up', investigator-driven funding arrangements, the European scientific community will play a strong role in determining the avenues of research followed under the program.

Industrial Leadership (EUR 17 016 million): This pillar aims to 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. It consists of three specific objectives:

[29] http://ec.europa.eu/research/participants/data/ref/h2020/legal_basis/rules_participation/h2020-rules-participation_en.pdf

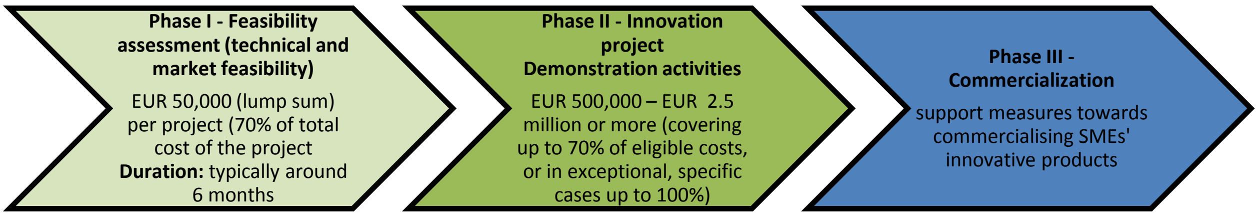
- "Leadership in enabling and industrial technologies" (EUR 13 557 million) will provide dedicated support for research, development and demonstration and, where appropriate, for standardization and certification, on information and communications technology (ICT), nanotechnology, advanced materials, biotechnology, advanced manufacturing and processing and space. Emphasis will be placed on interactions and convergence across and between the different technologies and their relations to societal challenges. User needs will be taken into account in all these fields.
- "Access to risk finance" (EUR 2 842 million) will aim to overcome deficits in the availability of debt and equity finance for R&D and innovation-driven companies and projects at all stages of development. Together with the equity instrument of the Program for the Competitiveness of Enterprises and small and medium-sized enterprises (COSME) (2014-2020) it will support the development of Union-level venture capital.
- "Innovation in SMEs" (EUR 616 million) will provide SME-tailored support to stimulate all forms of innovation in SMEs, targeting those with the potential to grow and internationalize across the single market and beyond.

A major novelty of the Horizon 2020 is the introduction of a dedicated SME instrument, which builds on and learns from the success of the SBIR like instrument. This SME instrument will address the financing needs of European SMEs in developing high-risk and high-potential innovation ideas. The SME instrument addresses the financing needs of internationally oriented SMEs, in implementing high-risk and high-potential innovation ideas. It aims at supporting projects with a European dimension that lead to radical changes in how business (product, processes, services, marketing etc.) is done. It launches companies into new markets, promote growth, and create high returns of investment. The SME instrument addresses all types of innovative SMEs so as to be able to promote growth champions in all sectors.

The SME Instrument offers small and medium-sized businesses the following[30]:

- Business innovation grants for feasibility assessment purposes (optional phase I): EUR 50,000 (lump sum) per project (70% of total cost of the project);
- Business innovation grants for innovation development & demonstration purposes (possible phase II): an amount in the indicative range of EUR 500,000 and 2,5 million (70% of total cost of the project as a general rule);
- Free-of-charge business coaching (optional in phases I and II), in order to support and enhance the firm's innovation capacity and help align the project to strategic business needs;
- Access to a wide range of innovation support services and facilitated access to risk finance (mostly in optional phase III), to facilitate the commercial exploitation of the innovation.

Figure 3: Three phase approach of the SME Instrument in H2020



[30] http://ec.europa.eu/programmes/horizon2020/en/h2020-section/sme-instrument

The goal is to make Europe a more attractive location to invest in research and innovation (including eco-innovation), by promoting activities where businesses set the agenda. It will provide major investment in key industrial technologies, maximize the growth potential of European companies by providing them with adequate levels of finance and help innovative SMEs to grow into world-leading companies.

Societal Challenges (EUR 29 679 million): Horizon 2020 reflects the policy priorities of the Europe 2020 strategy and addresses major concerns shared by citizens in Europe and elsewhere.

A challenge-based approach will bring together resources and knowledge across different fields, technologies and disciplines, including social sciences and the humanities. This will cover activities from research to market with a new focus on innovation-related activities, such as piloting, demonstration, test-beds, and support for public procurement and market uptake. It will include establishing links with the activities of the European Innovation Partnerships (EIP). Funding focuses on the following challenges:

- Health, demographic change and wellbeing (EUR 7 472 million);
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bio-economy (EUR 3 851 million);
- Secure, clean and efficient energy (EUR 5 931 million);
- Smart, green and integrated transport (EUR 6 339 million);
- Climate action, environment, resource efficiency and raw materials (EUR 3 081 million);
- Europe in a changing world - inclusive, innovative and reflective societies (EUR 1 309 million);
- Secure societies - protecting freedom and security of Europe and its citizens (EUR 1 695 million).

Spreading excellence and widening participation (EUR 816 million): Maximizing investment in research and innovation will enable the European Research Area to function in a more streamlined and homogeneous way, allowing the individual strengths of each Member State to be optimized.

Despite serious efforts deployed at national and European level, the European Union sees significant internal disparities among Member States in terms of research and innovation performance as also identified in the Innovation Union Scoreboard. These trends are further exacerbated by the continuing severe financial crisis, and the subsequent adverse effects on public research and innovation budgets.

Also, there is significant evidence pointing to the fact that the pathway to economic growth and competitiveness is strongly connected to the scaling up of investment in research and innovation.

In order to address these challenges, Horizon 2020 introduces specific measures for spreading excellence and widening participation:

- The **Teaming** action (associating advanced research institutions to other institutions, agencies or regions for the creation or upgrade of existing centers of excellence) is a new feature under Horizon 2020. It will provide new opportunities to the parties involved, with real prospects for growth through tapping into new collaboration and development patterns, including the establishment of new scientific networks, links with local clusters and opening up access to new markets. This will offer national and local research new possibilities for exploitation and value creation and boost the innovation potential of the countries involved.

- **Twinning** will help strengthen a defined field of research in a knowledge institution through linking with at least two internationally-leading counterparts in Europe.

- The **ERA Chairs** scheme will provide support for universities and other research institutions to attract and maintain high quality human resources and implement the structural changes necessary to achieve excellence on a sustainable basis.
- The **Policy Support Facility** will aim to improve the design, implementation and evaluation of national/regional research and innovation policies. It will offer expert advice to public authorities at national or regional level on a voluntary basis, covering the needs to access the relevant body of knowledge, benefit from the insight of international experts, use state of the art methodologies and tools, and receive tailor-made advice.
- Supporting access to international networks for excellent researchers and innovators who lack sufficient involvement in European and international networks. This will include support provided through **COST**.

These measures are targeted at low-performing Member States in terms of research and innovation, and they will be implemented by the Member States most in need of the new Cohesion policy for the 2014-2020 programming period.

Science with and for society (EUR 462 million): The aim of this program is to build effective cooperation between science and society, to recruit new talent for science and to pair scientific excellence with social awareness and responsibility.

The 'Science with and for Society' program will be instrumental in addressing the European societal challenges tackled by Horizon 2020, building capacities and developing innovative ways of connecting science to society. It will make science more attractive (notably to young people), increase society's appetite for innovation, and open up further research and innovation activities.

It allows all societal actors (researchers, citizens, policy makers, business, third sector organizations etc.) to work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of European society. This approach to research and innovation is called Responsible Research and Innovation (RRI).

European Institute of Innovation and Technology (EIT) (EUR 2 711 million): The EIT is bringing real and lasting change to the European Union's innovation landscape, by creating new environments where higher education, research, public administrations and business work together to produce disruptive innovation.

The European Institute of Innovation and Technology (EIT)[31] is a key driver of sustainable European economic growth and competitiveness. It works to reinforce the innovation capacity of the European Union and its Member States in order to address grand challenges facing European society. From 2014 to 2020, the EIT will receive € 2, 711.4 million to continue promoting innovation in Europe.

The EIT has been created to enhance Europe's ability to innovate by integrating, for the first time at EU level, education and entrepreneurship with research and innovation. The main operational arm of the EIT is its Knowledge and Innovation Communities (KICs)[32]. Through them the EIT develops and tests a new model of how innovation is approached, managed, financed and delivered in Europe. The KICs offer a genuine opportunity for top innovation players to be part of a highly collaborative community, based on the principles of excellence and commitment, to achieve pan-European impact.

In record time, the EIT and its existing Knowledge and Innovation Communities, or KICs, have brought about promising results. To date, the EIT's KICs bring together more than 500 leading partners from all over Europe, for the first time fully integrating business, research and higher education. Since 2010, the KICs have incubated more than 450 business ideas and created 75 innovative start-ups. 165

[31] http://eit.europa.eu/

[32] http://eit.europa.eu/kics/

knowledge transfers and adoptions have taken place and 61 new products and services have been launched. The first 215 students have graduated with EIT labeled degree programs[33].

The EIT's three initial KICs were established in 2010 to address:

- Climate change (Climate KIC[34]) , with priority thematic focus:
    - Greenhouse gas monitoring
    - Adaptation services
    - Making transitions happen
    - Sustainable city systems
    - The built environment
    - Land and water
    - Industrial symbiosis
    - Developing a bio-economy
- Sustainable energy (KIC InnoEnergy[35]), with priority thematic focus:
    - Electricity Storage
    - Energy Efficiency
    - Energy from Chemical Fuels
    - Renewable Energies
    - Smart and Efficient Buildings and Cities
    - Smart Electric Grid
    - Sustainable Nuclear and Renewable Convergence
- ICT innovation (EIT ICT Labs[36]) , with priority thematic focus:
    - Cyber-Physical Systems
    - Future Cloud
    - Future Networking Solutions
    - Health and Wellbeing
    - Privacy, Security & Trust in Information Society
    - Smart Energy Systems
    - Smart Spaces
    - Urban Life and Mobility

In December 2014 two additional KICs were established,[37] KIC RawMatTERS and the KIC InnoLife.

KIC RawMatTERS, has the mission to boost the competitiveness, growth and attractiveness of the European raw materials sector via radical innovation and entrepreneurship. In its focus, there are 6 thematic priorities:

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[33] http://eit.europa.eu/newsroom/eit-selects-new-strategic-partnerships-milestone-europe-areas-health-and-raw-materials
[34] http://www.climate-kic.org/
[35] http://www.kic-innoenergy.com/
[36] http://www.eitictlabs.eu/
[37] http://eit.europa.eu/newsroom/eit-selects-new-strategic-partnerships-milestone-europe-areas-health-and-raw-materials

- Exploration and raw materials resource assessment
- Mining in challenging environments
- Increased resource efficiency in mineral and metallurgical processes
- Recycling and material chain optimization for End-of-Life products
- Substitution of critical and toxic materials in products and for optimized performance
- Design of products and services for the circular economy

On its turn the KIC InnoLife has the mission is to promote entrepreneurship and develop innovations in healthy living and active ageing, providing Europe with new opportunities and resources. InnoLife will enable citizens to lead healthier and more productive lives by delivering products, services and concepts that will improve quality of life and contribute to the sustainability of healthcare across Europe. In its focus, there are three specific challenges and three cross challenges

Specific challenges:

- To promote healthy living
- To support active ageing
- To improve healthcare

Three cross challenges:

- Removing barriers to innovation
- Leveraging talents and education
- Enabling technologies and exploiting big data

Within the Horizon 2020 programming period 2014-2020, EIT plans to launch a further 3 new KICs:

- Added-value manufacturing (2016)
- Food4Future – sustainable supply chain from resources to consumers (2016)
- Urban mobility (2018)

Non-nuclear direct actions of the JRC (EUR 1 903 million): The Joint Research Centre (JRC) is the in-house science service of the European Commission. Its mission is to provide scientific and technical support to EU policy making, thus operating at the interface between research and EU policy and to complement other Horizon 2020 funded research. It provides input throughout the whole policy cycle from conception to implementation and evaluation.

EURATOM (EUR 1 603 million): Euratom is a complementary research program for nuclear research and training. The aim of Euratom is to pursue nuclear research and training activities with an emphasis on continually improving nuclear safety, security and radiation protection, notably to contribute to the long-term de-carbonization of the energy system in a safe, efficient and secure way. By contributing to these objectives, the Euratom Program will reinforce outcomes under the three priorities of Horizon 2020: Excellent science, Industrial leadership and societal challenges. The indirect actions of the Euratom Program focus on two areas:

- Nuclear fission and radiation protection
- Fusion research aiming at developing magnetic confinement fusion as an energy source.

The Euratom Program puts a strong emphasis on developing nuclear skills and competence. This will allow Europe to maintain world leadership in nuclear safety and waste management and to attain the highest level of protection from radiation. In particular, the Program will be carrying out research in the medical uses of radiation, for the benefit for all European citizens.

For fusion research, the Program calls for a substantial reorganization that will support a shift from pure, academic research to scientific questions of designing, building and operating future facilities such as ITER. This will allow fusion to progress towards electricity production by fusion around the middle of the century.

To achieve these objectives, the nuclear research activities will be supported by simpler legislation, thereby facilitating access to funding for companies, universities, research institutes in all EU Member States and beyond. In line with the Euratom Treaty, the Program will run for five years, from 2014 to 2018.

The Euratom Research and Training Program have the following specific objectives:

- Support safety of nuclear systems;
- Contribute to the development of safe longer term solutions for the management of ultimate radioactive waste;
- Support the development and sustainability of nuclear expertise and excellence in the European Union;
- Support radiation protection and development of medical applications of radiation, including, inter alia, the secure and safe supply and use of radioisotopes;
- Move toward demonstration of feasibility of fusion as a power source by exploiting existing and future fusion facilities;
- Lay the foundations for future fusion power plants by developing materials, technologies and conceptual design;
- Promote innovation and industrial competitiveness;
- Ensure availability and use of research infrastructures of pan-European relevance.

COSME: COSME is the EU program established to support competitiveness of enterprises and SMEs, running from 2014 to 2020. The planned budget to be spent under COSME actions is € 2.3 bn. The four areas of intervention by this program include:

- Better access to finance for SMEs. To facilitate and improve access to finance for SMEs, two financial instruments will be made available:
    - The loan guarantee facility, through which the COSME budget will fund guarantees and counter-guarantees for financial intermediaries (e.g. guarantee organizations, banks, leasing companies) to help them provide more loans and lease finance to SMEs. This facility will also include securitization of SME debt finance portfolios. By sharing the risk, the COSME guarantees will allow the financial intermediaries to expand the range of SMEs they can finance. This will facilitate access to debt finance for many SMEs who might otherwise not be able to get the funding they need.
    - The equity facility for growth: the COSME budget will also be invested in funds that provide venture capital and mezzanine finance to expansion and growth-stage SMEs in particular those operating across borders. The fund managers will operate on a commercial basis, to ensure that investments are focused on SMEs with the greatest growth potential.
- Access to markets: All businesses have access to the services of the Enterprise Europe Network and can freely approach the local partner in their region. Over 500 partner organizations in 44 countries have built a capacity to reach out to more than 2 million SMEs. The services offered include:
    - Information concerning EU legislation and participation in EU programs (H2020, regional funds)

  - Assistance to find a business partner abroad
  - Advice on EU access to finance
  - Support to innovation and technology transfer
  - Obtaining SME's opinion on EU legislation.
- Supporting entrepreneurs: The Entrepreneurship 2020 Action Plan[38] is a decisive call for joint action at European, national, regional, and local level. Initiatives under the Action Plan include three main improvements:
  - Entrepreneurial education – COSME will support exchanges among European educators and trainers on best practice in entrepreneurship education in the EU
  - Improving the business environment so entrepreneurs can grow and flourish – together with improving the legal and fiscal environment, experts will also develop recommendations on the best support for businesses throughout their lifecycles. Specific support for web entrepreneurs will be provided.
  - Role models and outreach to specific groups – under COSME groups such as young people, women or senior entrepreneurs will be able to benefit from mentoring or other tailored programs.
- More favorable conditions for business creation and growth, meaning:
  - Action program for reducing administrative burden on businesses by removing unnecessary reporting and information requirements.
  - Identification and exchange of good practices among national administrations to improve SMEs policy
  - Analytical tools for better policy
  - Sectorial actions (e.g. tourism)

Whereas the main beneficiaries will be entrepreneurs and in particular in SMEs, that will benefit from easier access to funding for development, consolidation and growth of their enterprises, citizens who want to become self-employed and face difficulties in setting up their own business, for instance young and women entrepreneurs. In addition Member States' authorities (at national, regional and local level), will be better assisted in their efforts to elaborate and implement effective policy reform. In particular, they will benefit from EU-wide reliable data and statistics, best practice and financial support to test and scale up sustainable solutions for improving global competitiveness. The program is being managed by EASME (Executive Agency for SMEs)

Smart specialization strategy[39] (2014-2020)

As already presented in the funding schemes and policy measures 2007-2013 smart specialization already exists. Smart specialisation is about identifying the unique characteristics and assets of each country and region, highlighting each region's competitive advantages, and rallying regional stakeholders and resources around an excellence-driven vision of their future.

This implies strengthening regional innovation systems, maximising knowledge flows and spreading the benefits of innovation throughout the regional economy by setting concrete priorities regarding fields, technologies and activities and additionally involving entrepreneurial knowledge and thus combining science, technology, engineering with knowledge of market developments, business needs and emerging opportunities. Regarding the changes to the activities of 2007-2013 the Commission proposed to make such strategies a pre-condition for ERDF funding and therefore EU Members States and regions must have RIS3 strategies in place before their Operational Programs supporting these investments are approved[40].

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38 http://ec.europa.eu/enterprise/policies/sme/entrepreneurship-2020/index_en.htm
39 http://ec.europa.eu/research/regions/index_en.cfm?pg=smart_specialisation
40 http://ec.europa.eu/regional_policy/sources/docgener/informat/2014/smart_specialisation_en.pdf

Cluster policies (2014-2020)

During the period 2014-2020 cluster policies will be focusing more strongly on cross-sectoral linkages and the competitiveness and entrepreneurship opportunities in emerging industries. Emerging industries are new industrial sectors or existing industrial sectors and value chains that are evolving into new industries.

A new Horizon2020 action named "Cluster facilitated projects for new industrial value chains"with a budget of 24.9 million from the Innovation in SMEs work program, will start in 2015. The specific challengethe action is aimed at is to develop new cross-sectoral industrial value chains across the EU, by building upon the innovation potential of SMEs. The EU needs to support the development of emerging industries, which will provide the growth and employment of the future. The reindustrialization of the EU's industrial base has to focus on the development of long-term internationally competitive goods and services that require combining different competences and innovative solutions[41]. In the same time there are also six projects for "Clusters and Entrepreneurship in support of Emerging Industries" (2014-2016 funded by the CIP) and two "European Creative Districts" (2013-2015) funded as pilot actions by the European Parliament. Finally, also the European Cluster Observatory is focusing more strongly on cross-sectoral linkages and the competitiveness and entrepreneurship opportunities in emerging industries.

1.2.3 Innovation funding trends

As pointed out in the Annual Growth Survey 2014 (AGS)[42], "2014 will be the first year of implementation of the new European multi-annual financial framework. Besides projects jointly undertaken at EU level to boost Europe-wide innovation and infrastructure, an investment capacity of more than EUR 400 billion will be mobilized to increase growth and jobs at national and regional level through the European Structural and Investment Funds (ESIF). Eligibility to receive funding is restricted to Europe-based firms. However, U.S. firms may participate in projects receiving EU funding if they have subsidiaries located in any of the 28 European Union countries. Subsidiaries legally registered in an EU Member State, are considered "European firms", and, as such, are eligible.

The Commission has been discussing priorities with the Member States and is also providing technical assistance to make sure operational programs can start swiftly. The new ESIF will support the goals of the Europe 2020 strategy and will be used to support reforms as identified in the EU country-specific recommendations. This is the first time that policy and funding are being brought together, as this can be a very powerful growth driver, provided that funds are concentrated on the selected priorities.

The Commission, in its guidance for policy-makers and implementing bodies, identified synergies between the different Union funds as strengthening the research and innovation investments and their impact, combining different forms of innovation[43] and competitiveness support[44], or carrying innovative ideas further along the innovation cycle or value chain to bring them to the market. Synergies by combining ESIF, Horizon 2020 and other EU instruments in a strategic and also cohesion-oriented manner will have as a result more impacts on competitiveness, jobs and growth in the EU. The Commission strongly encourages synergies through bringing together Horizon2020 and

[41] http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-sme_en.pdf

[42] http://ec.europa.eu/europe2020/making-it-happen/annual-growth-surveys/index_en.htm

[43] This concerns all forms of innovation, including social innovation, service innovation, design, creativity, process innovation, work place innovation, user-driven innovation, public sector innovation, etc.

[44] E.g. by fostering SME internationalisation, the development of innovation and specialised business support services and improved policy making and analysis

ESIF money in the same project (possible only for Horizon 2020), or through successive projects that build on each other or parallel projects/roadmaps that complement each other[45].

The combination of the strengthened EU system of economic governance, the new EU multi-annual financial framework and EU-level policies such as completing the Internal Market and connecting Europe through physical infrastructure and pursuit of the digital agenda, amounts to real progress in creating the EU-level framework conditions for future growth in Europe".

The EU and its Member States should pursue – and in some cases reinforce – their focus on making progress in the following five priority areas, with varying degrees of emphasis:

- **Pursuing differentiated, growth-friendly fiscal consolidation**
  - Fiscal consolidation should be a growth-friendly mix of expenditure and revenue measures, putting more emphasis on the quality of public expenditure, and the modernization of administration at all levels. Where greater fiscal room for manoeuvre exists, private investment and consumption should be stimulated, for instance through tax cuts and reductions of social security contributions.
  - Longer term investment in education, research, innovation, energy and climate action should be protected and the needs of the most vulnerable in our society should be catered for.
  - Tax should be designed to be more growth-friendly, for instance by shifting the tax burden away from labor on to tax bases linked to consumption, property, and combating pollution.
- **Restoring lending to the economy**
  - Restructuring and repair of banks: this includes adopting and implementing the Banking Union swiftly as well as strengthening the capacity of banks to manage risks in line with the new rules on capital requirements and preparing for the asset quality reviews and stress tests.
  - Developing alternatives to bank financing, including options for venture capital, development of SME bonds and alternative stock markets.
  - Close monitoring of private debt levels and associated financial risks, such as real estate bubbles, and the impact of corporate and personal insolvency regimes, where necessary. This also includes schemes creating a tax bias towards debt financing.
- **Promoting growth and competitiveness for today and tomorrow**
  - Full implementation of the third energy package in 2014 and improving the cost effectiveness of support schemes for renewable energy. Promoting resource efficiency by improving waste and water management, recycling and energy efficiency.
  - Improving the implementation of the Services Directive, including through the screening of restrictions affecting access to regulated professions, and their replacement where appropriate, with less restrictive mechanisms.
  - Accelerating the modernization of national research systems in line with the objectives of the European Research Area.
- **Tackling unemployment and the social consequences of the crisis**
  - Stepping up active labor market measures, notably active support and training for the unemployed, improving the performance of public employment services and implementing a Youth Guarantee.
  - Further reform efforts to ensure that wage developments should be in line with productivity and thus support both competitiveness and aggregate demand, to remedy labor market segmentation, notably by modernizing employment protection

[45] Enabling synergies between European Structural and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programs Guidance for policy-makers and implementing bodies

legislation, to support job creation in fast-growing sectors and to facilitate labor mobility.
    - Pursuing the modernization of education and training systems, including life-long learning, vocational training and dual learning schemes.
    - Improving the performance of social protection systems, in particular by strengthening the link between social assistance and activation measures through access to more personalized services ("one-stop shop") and efforts to simplify and better target benefits with particular attention to the situation of the most vulnerable.
- **Modernizing public administration.**
    - Further deploying e-government services and increasing the use of ICT by public administrations, including for tax collection systems, and for single market points of contact of the Services Directive.
    - Simplifying the business environment, reducing red tape through the introduction of lighter processes and regulatory regimes.

1.2.4 Business Financing System - the role of EEN

The European Union (EU) supports entrepreneurs and businesses with a wide range of EU programs; this is materialized through the provision of loans, guarantees, venture capital and other equity financing. These financial instruments are managed by financial intermediaries such as banks, venture capital funds and other financial institutions.

The Commission makes also direct financial contributions in the form of grants in support of projects or organizations which further the interests of the EU or contribute to the implementation of an EU program or policy. Interested parties can apply by responding to calls for proposals.

On the other hand, through the Structural Funds, the Commission provides funding which is directly managed by each Member State. For every program, a managing authority is designated (at national, regional or another level) which will inform potential beneficiaries, select the projects and generally monitor implementation.

The Enterprise Europe Network (EEN) offers support and advice to European SMEs; their aim is to help them make the most of business opportunities beyond national and European Union borders.

The network brings together business support from 570 partner organizations in 44 countries. It I Europe's largest business and technology network, able to help small companies to find suppliers, distributors, trustworthy export partners and ways to source or sell technology.

The partners include chambers of commerce, enterprise agencies, regional development organizations, research institutes, universities, technology and innovation centers.

The network is strongly rooted in local communities and regions across Europe, and thus can provide information on EU legislation and funding; it can help companies find business partners, especially in other countries, and offers advice on how to develop innovative ideas. The network can also help increase chances of successful participation when tendering for EU contracts or funding.

The Enterprise Europe Network is an initiative of the European Commission's Directorate General for Enterprise and Industry. It is a key instrument of the Competitiveness and Innovation Framework Program (CIP), which focuses on supporting SMEs in their growth and innovation activities. The Executive Agency for Competitiveness and Innovation (EACI) is responsible for managing the Network on a daily basis. Currently there are four points of contact of EEN in the U.S. located in Cleveland, Durham, New York and San Diego. This is not feasible, and there is a real call from European businesses to enlarge the EEN database with American organizations. Also, it was remarked that a number of countries support their EEN nodes from national sources, as this is considered strategically important to reinforce business and innovation collaboration between the countries. It is currently not the case in the U.S..

The EUREKA program

EUREKA is an intergovernmental organization for market-driven industrial R&D. It is a decentralized network facilitating the coordination of national funding on innovation as participants are funded by national budgets, aiming to boost the productivity & competitiveness of European industries. The network integrates over 40 pan-European economies, but also includes Israel, South Korea, and Canada, however not the U.S. Following a bottom-up approach with projects being in any technological area with a civilian purpose, EUREKA has been the driving force of innovation in Europe for over 25 years.

COST (European Cooperation in Science and Technology)

COST is one of the longest-running European frameworks supporting cooperation among scientists and researchers across Europe. It is an intergovernmental framework for European Cooperation in Science and Technology, allowing the coordination of nationally-funded research on a European level. COST contributes to reducing the fragmentation in European research investments and opening the European Research Area to cooperation worldwide. It anticipates and complements the activities of the EU Framework Programs, constituting a "bridge" towards the scientific communities of emerging countries. It also increases the mobility of researchers across Europe and fosters the establishment of scientific excellence in the nine key science and technology fields: Biomedicine and Molecular Biosciences, Food and Agriculture, Forests, their Products and Services, Materials, Physics and Nanosciences, Chemistry and Molecular Sciences and Technologies, Earth System Science and Environmental Management, Information and Communication Technologies, Transport and Urban Development and Individuals, Societies, Cultures and Health.

1.2.5 Procurement policy[46]

Traditionally EU programs have focused on a supply-side approach to research and innovation. Horizon 2020 increases the focus on demand-side policies aiming to pull innovation forward by offering incentives or rewards for the results of research and innovation. These policies work in combination with the supply-side policies, helping steer EU funded research into tangible outputs, beneficial for both EU citizens and businesses.

Public procurement is at the centre of the demand-side innovation policy initiatives. Governments' large purchasing power allows them to pull demand for innovation, creating a signaling effect as lead user, increasing the diffusion of innovations more broadly.

Support for innovative public procurement is an important demand side policy under Horizon 2020 and pre-commercial procurement (PCP) is officially introduced as a new funding instrument to be used across all areas of research and innovation supported by the Commission.

Public procurement makes up an important share, around 15-20%, of GDP in developed economies, and public authorities are often the largest purchaser. Therefore awarding public contracts to new and innovative ideas is a powerful tool for stimulating innovation. This has two main benefits:

- European citizens benefit from improved public services, that make use of new and emerging technologies faster,
- Innovative European companies benefit from investment in research and development (R&D) and large, stable contracts that help them bring their products to the mass market faster.

Horizon 2020 supports innovative public procurement through two processes known as PPI and PCP:

- ***Procurement of innovative solutions (PPI):*** PPI involves public procurers acting as a launching customer or early adopter of a new product or service. This allows the public

[46] http://ec.europa.eu/digital-agenda/en/innovation-procurement

procurer to benefit from new products faster, while the innovative company has the incentive and means to commercialize the product on the mass market.

- ***Pre-commercial procurement (PCP):*** PCP is used when there is no solution available - or close to being available - on the market. It involves procuring solutions that still require further research and development before they are commercially available.

PCP and PPI are separate but complementary procedures. Implementing and using them together wherever possible, maximizes European competitiveness. As R&D services procurement falls outside of the World Trade Organization (WTO) rules, PCPs can require suppliers to locate the majority of the R&D and first production activities in Europe. Starting PCPs on ground breaking topics followed directly by PPIs on the same issue, gives companies willing to locate R&D/PCP activities in Europe a first mover advantage, increasing the chances they will win the follow-up PPI contracts.

The funding instruments of Horizon 2020 in support of PCP-PPI have three forms[47]

- Coordination and Support Actions (100% funding rate): Support only coordination activities e.g. for preparation of a PCP or PPI by a group of procurers (identifying common challenges among procurers, conducting open market consultations before starting a PCP or PPI etc)
- PCP co-fund Actions (70% funding rate): Provides EU co-funding for an actual PCP procurement (one joint PCP procurement per action) + for related coordination and networking activities (e.g. to prepare, manage and follow-up the PCP call for tender)
- PPI co-fund Actions (20% funding rate): Provides EU co-funding for an actual PPI procurement (one joint PPI procurement per action) + for related coordination and networking activities (e.g. to prepare, manage and follow-up the PPI call for tender)

Conditions for participation in PCP and PPI co-fund actions are:

- Minimum of 3 independent legal entities from 3 different Member States or associated countries, minimum 2 of which are public procurers from different Member States or associated countries
    - Public procurers are contracting authorities or contracting entities as defined in the EU public procurement directives
    - Sole participant is possible, if it meets minimum participation requirements
- They can be complemented by other types of procurers that are providing services of public interest and share the same need to procure R&D or innovative solutions
    - E.g. NGOs or private procurers on the condition that they are not potential suppliers of solutions sought for by the procurement and have no other type of conflict of interest with the procurement undertaken in the action.
- Other entities may participate as direct beneficiaries on condition that they add value to the action, are not potential suppliers of solutions sought for by the PCP/PPI and have no other type of conflict of interest
    - Assisting the procurers in the preparation, implementation and follow-up

In the 2014 – 2015 work-program of Horizon 2020 the budget in support of PCP/PPI will be about € 130 - 140 million. Nine areas have calls to co - fund PCPs (1 in e - Health , 6 in ICT, 1 in security, 1 in infrastructure) whereas six areas have calls to co - fund PPIs (1 in e - Health , 3 in ICT, 1 in Transport, 1 in infrastructure).

[47] Public Demand Driven Innovation: Innovation Procurement (PCP and PPI) in Horizon 2020 http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?action=display&doc_id=4069.
More information on the specific conditions:
http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf

1.2.6 Assessing innovation policy effectiveness

The European Union has a long standing evaluation culture and has formal procedures for evaluation and monitoring its research and innovation policies. Apart from the Innovation Union Scoreboard[48], which provides statistical evidence on the EU innovation performance and latest trends, the Commission also annually presents a report on the state of the Innovation Union, reflecting the actual progress in terms of achievement of the already set out objectives. The latest version of this report was published in 2013, reflecting progress made within 2012[49].

According to the status report, in 2012, quite some progress was made in implementing the Innovation Union (IU). More than 80% of the IU commitments are on track with on-going initiatives. There are some areas where more effort is needed. The need for a more strategic use of innovation procurement (i.e. adoption of the Single Market Act I proposals and rolling out the initiatives on the intellectual property valorization) is one of them.

Still, the Commission's objective is to create a climate of confidence and set the environment for EU businesses and citizens through the Innovation Union. The means for this to be achieved is through sustained investment in research and innovation and even more effective reforms that will help create the European Research Area, by improving framework conditions for innovative businesses and by better matching supply- and demand-side measures.

As indicated in the report, more attention needs to be placed to the role of regional innovation policy to balance and – possibly - make up for the talent brain drain from Europe's less-favored regions towards Europe's research excellence hotspots.

At the same time of the implementation of the agreed Innovation Union measures, the Commission worked on the preparation of the next steps required for deepening the Innovation Union. These were based on emerging trends, expert advice and views of stakeholders and were focused on [50]:

Table 1: Next steps required for deepening the Innovation Union (2012)

Accelerating structural change within existing sectors and by diversifying into new emerging sectors, and supporting the development of high-growth innovative enterprises through EU policies and coordinated additional initiatives.
Closing the innovation divide between European regions through smart specialization and synergies between Horizon 2020 and the structural funds.
Working on innovation-friendly framework conditions for innovative businesses, including innovation clusters.
Identifying concrete ways of boosting innovation in and through the public sector.
Developing a coherent policy approach for open innovation and knowledge transfer.
Accounting for the value of intellectual property, facilitating patent valorization and ensuring the sound and effective protection of know-how and confidential business information in order to facilitate knowledge transfer.
Driving retail innovation as a key action of the European Retail Action Plan, helping smooth the path from idea to market for innovative products and services by tapping the potential of the retail sector with its economic weight (4.3% of EU GDP and 8.3 % of EU employment) and direct contact with consumers.
Combining new technologies and services with innovation in business models.

48 http://ec.europa.eu/enterprise/policies/innovation/policy/innovation-scoreboard/index_en.htm
49 http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2012/state_of_the_innovation_union_report_2012.pdf
50 http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2012/state_of_the_innovation_union_report_2012.pdf

As already presented earlier many of these steps have been implemented for example the S3 platform and cluster international policy schemes w set up. According to the State of the Innovation Union "Taking stock 2010 – 2014" report[51] "over the past years, a fundamental shift in the right direction has happened, reducing the innovation performance gap with our main competitors. The latest Innovation Union Scoreboard shows that, since 2008, the EU has managed to close almost half of its innovation performance gap with the US and Japan. Nevertheless, the gap with South Korea is widening and China is quickly catching up. As a consequence, we should not be content with the results achieved and stop paying the necessary attention to Europe's innovation performance. The EU, its Member States and other stakeholders need to continue working together to improve the European innovation eco-system".

To fully capture the potential of research and innovation as sources of renewed growth, the following are crucial elements[52]:

- Member States need to prioritize growth enhancing expenditure, notably on R&I.
- Investments need to go hand in hand with reforms to increase the quality, efficiency and impacts of public R&I spending, including by leveraging business investment in R&I.
- Member States should focus on three main axes of reform, relating to the quality of strategy development and the policy making process; the quality of programs, focusing of resources and funding mechanisms; and the quality of R&I performing institutions.
- To assist Member States in the successful implementation of R&I reforms, the Commission will draw on the experience gained under the Innovation Union flagship initiative and European Research Area, and fully exploit the Research and Innovation Observatory and the Policy Support Facility foreseen in Horizon 2020 in order to support an integrated and evidence-based approach to policy making and budgetary decisions.
- Strengthening the broader innovation eco-system and putting in place the right framework conditions to stimulate Europe's companies to innovate is crucial. Important progress has been made since the launch of the Innovation Union, but further efforts need to be made in deepening the Single Market, facilitating and diversifying access to finance, strengthening the innovation capacity of the public sector, creating resilient jobs in knowledge intensive activities, developing a human resource base equipped with innovation skills, fostering frontier research, addressing the external dimension of R&I policy, and embedding science and innovation more strongly in society. The review of the Europe 2020 strategy will examine the progress made with the Innovation Union.

1.2.7 Internationalization of innovation policies[53]

Research and innovation at the international level become more and more linked to one another. Not only the developed, industrialized countries but also the latest emerging economies have placed emphasis on further developing and strengthening their research and innovation systems. "The focus of the new International Cooperation strategy of the European Union focuses on research and innovation, in areas of common interest and mutual benefit".

As discussed in the Commission communication to the Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "Enhancing and focusing EU

[51] http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2013/state_of_the_innovation_union_report_2013.pdf
[52] http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2013/research-and-innovation-as-sources-of-renewed-growth-com-2014-339-final.pdf
[53] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "Enhancing and focusing EU international cooperation in research and innovation: A strategic approach".
http://ec.europa.eu/research/iscp/pdf/policy/com_2012_497_communication_from_commission_to_inst_en.pdf#view=fit&pagemode=none

international cooperation in research and innovation: A strategic approach", international cooperation in research and innovation contributes to the broader policies of the European Union - as reflected in the Europe 2020 strategy - in supporting the following objectives:

(a) Strengthening the European Union's excellence and attractiveness in research and innovation as well as its economic and industrial competitiveness – by creating 'win-win' situations and cooperating on the basis of mutual benefit; by accessing external sources of knowledge; by attracting talent and investment to the European Union; by facilitating access to new and emerging markets; and by agreeing on common practices for conducting research and exploiting the results;

(b) Tackling global societal challenges – by developing and deploying effective solutions more rapidly and by optimizing the use of research infrastructures; and,

(c) Supporting the Union's external policies – by coordinating closely with enlargement, neighborhood, trade, Common Foreign and Security Policy (CFSP), humanitarian aid and development policies and making research and innovation an integral part of a comprehensive package of external action.

"International cooperation in research and innovation is considered as an instrument of soft power and a mechanism for improving relations with key countries and regions. Good international relations facilitate effective cooperation in research and innovation".

The EC Communication proposes "to enhance and focus the Union's international cooperation activities in research and innovation by using the dual approach of openness complemented by targeted international cooperation activities, developed on the basis of common interest and mutual benefit, optimal scale and scope, partnership, and synergy".

The Union's engagement with countries and regions across the globe will consequently lead researchers and innovators to consequently engage on a stakeholder-driven basis with their counterparts worldwide. As stated in the Communication, the target is for:

- Horizon 2020 to be fully open to participation from all over the world;
- The European Research Council and Marie Skłodowska-Curie actions to operate on a fully researcher-driven basis; open to researchers from all countries worldwide.
- The Research Infrastructures activity to have a specific focus on international cooperation. Its e-Infrastructures component has an inherent international dimension by supporting collaboration through digital means.
- Not all other country participants will be automatically eligible for funding; the list of countries eligible for automatic funding will be restricted, by complementing the current selection criterion, based solely on Gross National Income (GNI) per capita, with an additional criterion based on total Gross Domestic Product (GDP), excluding countries above a defined threshold. This will address the fact that some countries have established the critical mass needed to cooperate on a reciprocal basis with the European Union. Similarly as for the industrialized countries, funding for participants from these countries continues to be possible in exceptional cases;
- The more restrictive approach to automatic funding will be counterbalanced by increased efforts to facilitate the funding of participants through their national channels;
- The European Union will continue to encourage reciprocal access to third countries' programs. The Horizon 2020 proposals allow for limiting the geographical scope of calls, for instance when the conditions for the participation of legal entities from Member States in the third country's programs are considered to be prejudicial to the Union's interest or satisfactory security guarantees cannot be provided;

The support provided for the COST and EUREKA (programs will further enhance European research networks cooperation with third country relevant networks. With regards to partners in EU projects from the USA: U.S. structures are eligible for participation in EU projects, but financial support is only true for calls where this is specified, e.g. International Cooperation calls targeting collaboration with the USA or the "Health" program in general. Furthermore, researchers from any country can participate in Horizon 2020, but the transfer of funds to a legal entity outside member or associated states depends on their participation being deemed essential to the project, or funding is provided under a bilateral S&T agreement.

The role of JRC in internationalization of RTDI – focus on the U.S.

The role of the Joint Research Centre (JRC) of the European Commission is very important in terms of S&T collaboration. The JRC collaborates with U.S. partners in Framework Program projects, in scientific networks and in several collaboration agreements. In terms of this collaboration JRC does not fund any such cooperation, and also does not receive funding from US organizations.

The JRC collaborates with organizations which share a common interest in specific research areas. This collaboration is essential for the JRC's work on harmonizing and validating methods and measurements, establishing common standards, and providing scientific and technical support for the implementation of EU legislation. The JRC collaborates with over 650 partner organizations in around 60 institutional networks worldwide.

This collaborative work covers a wide range of areas including food security, nanotechnology, consumer safety, food allergens, fuel cells, low-carbon technology, alpha-radio-immuno-therapy, nuclear safeguards and safety, combating nuclear smuggling, remote-sensing, standardization of measurements in life sciences, and atmospheric dispersion models.

Indicative U.S. partners include:

National authorities and laboratories

- American Association for the Advancement of Science
- Department of Energy:
- Argonne National Laboratory
- National Renewable Energy Laboratory
- Oak Ridge National Laboratory
- National Oceanic and Atmospheric Administration
- National Institutes of Health
- National Aeronautics and Space Administration (NASA)
- National Institute of Standards and Technology
- U.S. Geological Survey
- U.S. Food and Drug Administration
- U.S. Department of Agriculture: Forest Service

Academia

- Duke University, North Carolina
- University of Nebraska
- Pacific Disaster Center, University of Hawaii
- Virginia Polytechnic Institute and State University
- University of California
- Rutgers, The State University of New Jersey
- University Corporation For Atmospheric Research

Specific collaboration Arrangements

The JRC has around 200 operational collaboration agreements and Memoranda of Understanding with public and private research organizations, universities, and national and international bodies. The majority of these agreements concern joint research, information sharing and the exchange of personnel. Some examples of collaboration agreements with U.S. partners are:

- Bilateral Collaboration Arrangements on disaster monitoring and impact analysis, with the Pacific Disaster Center of the University of Hawaii. This collaboration fosters disaster related research and development including flood monitoring and alerting, tsunami modeling and alerting and disaster information sharing.
- Bilateral Collaboration Agreement on targeted alpha therapy with the Rutgers University of New Jersey. Through this agreement, the JRC and Rutgers University aim to develop targeted alpha therapy of tumor vasculature.
- JRC-Department of Energy Letter of Intent. This cooperation focuses on e-mobility and electric vehicle interoperability.
- JRC-National Oceanic and Atmospheric Administration Implementing Arrangement with National Oceanic and Atmospheric Administration (NOAA). This collaboration fosters activities in the fields of climate, weather, oceans and coasts.
- JRC-National Institute of Standards and Technology Implementing Arrangement with the National Institute of Standards and Technology (NIST).This collaboration includes activities related to standards and measurements in fields of common interest.

1.2.8 Future Challenges for Innovation Policy[54]

As Europe seeks to recover from the current economic downturn, the aim of economic policy is long-term, sustainable growth. "With an ageing labor force and increased competition for limited natural resources, this growth will have to be founded upon greater productivity, which in turn will be unlocked through innovation"[55].

Although there is progress both at national and EU level, there are still some very important issues that need to be appropriately addressed at the policy level. These include:

- Prioritizing growth enhancing expenditure on R&I in line with the concept of growth friendly fiscal consolidation
- Setting the scene and creating the environment that will lead to changes in business culture and that will lead firms to realize that their focus should be on market and user needs; these should be their starting point for making decisions concerning investing in research, development and innovation.
- Creating the necessary framework conditions and regulations and improving the existing infrastructure in order to facilitate the innovation process.
- Create initiatives that will shift attention and focus also towards non-R&D based innovation.
- Improve coordination of policies promoting the "research triangle" in order to ensure the development and enhancement of the European Research Area.
- Improve the access to risk finance for innovative small and medium-sized companies.
- Improve coordination between EU financial instruments for micro-enterprises and SMEs.

[54] Knut Blind, Luke Georghiou, "Putting Innovation in the centre of Europe – Suggestions for a European Innovation Strategy", Intereconomics, 2010.
[55] Ibid.

- Place more focus in improving the liaison between academia and industry, academia and research institutes and between enterprises and the government, to better facilitate the flows of knowledge, resources and people.
- Promote the creation of more effective clusters, poles, science and technology parks and districts, and other spatial policies for creating local innovative clusters.
- Certain challenges identified by other nations are not covered by Horizon 2020. These challenges identified by other nations may constitute a basis for further consideration by Horizon 2020. For example, India has identified building education and skills as a strategy challenge and the US has a large program on space. [56].
- Horizon 2020 aims to maintain strong relationships with the US. But this should not obscure the building of relationship with emerging economies. Collaboration with emerging economies does not only imply a transfer of knowledge part of a capacity building exercise with these economies, but may also result in learning to help solve some of Europe's most fundamental challenges, such as how to build a trade-off between growth and inclusion[57].
- International research collaboration requires researchers with a multidisciplinary and broad skillset. The European Commission needs to support researchers in acquiring such skills at the early stages of doctoral training[58].
- The European Commission is also encouraged to establish further links with other intergovernmental initiatives aiming to solve societal challenges[59].
- A sound evaluation of the impact of research collaboration would be required in order to assess its broad impact[60].

Investments need to go hand in hand with reforms to increase the quality, efficiency and impacts of public R&I spending, including by leveraging business investment in R&I. In doing so, Member States should focus on three main axes of reform, relating to the quality of strategy development and the policy making process; the quality of programs, focusing of resources and funding mechanisms; and the quality of R&I performing institutions. Strengthening the broader innovation eco-system and putting in place the right framework conditions to stimulate Europe's companies to innovate is crucial. Important progress has been made since the launch of the Innovation Union, but further efforts need to be made in deepening the Single Market, facilitating and diversifying access to finance, strengthening the innovation capacity of the public sector, creating resilient jobs in knowledge intensive activities, developing a human resource base equipped with innovation skills, fostering frontier research, addressing the external dimension of R&I policy, and embedding science and innovation more strongly in society[61].

[56] ERIAB "The international dimension of research and innovation cooperation addressing the grand challenges in the global context" Final Policy Brief, May 2014. http://ec.europa.eu/research/innovation-union/pdf/expert-groups/eriab_final_policy_brief_international_R&I_cooperation.pdf
[57] Ibid.
[58] Ibid
[59] Ibid
[60] Ibid
[61] COM (2014) 339 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: "Research and innovation as sources of renewed growth"

2 USA: Innovation Policy Overview

Innovation policy in the United States is highly decentralized with many cutting-edge practices being designed, implemented, and evaluated at the state level. Examples for such programs can be found in Ohio's Third Frontier Program; in New York's NYSTAR program, in Maryland's TEDCO, and Pennsylvania's Ben Franklin programs. All of them support funding, accelerating R&D; proof of concept; access to innovation networks etc. Thus, there is a highly diverse policy environment across the 50 states to support innovation and entrepreneurship. Federal investments in innovation through the National Science Foundation and federal agencies such as the Department of Defense and the Department of Energy, for example, help fuel innovation. In addition, recent cluster-focused grants such as the Economic Development Administration's Regional Innovation Grants are aimed to support state and regional cluster development to encourage innovation[62]. This section covers innovation policy from a perspective of how the federal government essentially invests and supports state and local innovation ecosystems.

The United States has been leading cutting-edge innovation for a long time. The country has excellent higher education institutions, a large and integrated marketplace, and efficient capital and equity markets. It leads the OECD in shares of Gross Domestic Expenditure on R&D (GERD) (41%), triadic patent families (29%) and scientific publications (31%). It hosts nearly a third of the world's largest corporate R&D investors[63].

Despite the high ranking of the U.S. in global scale, it is important to stress, that currently the following are key policy topics in the U.S.:

- Creating a 21st century workforce and research infrastructure[64,65]
- The lack of policy to address H-B1 visas' issue[66]
- The increasing need for STEM[67] education throughout K-16 education[68].

The U.S. research system heavily relies on an R&D-intensive business sector (2.04% of Gross Domestic Product (GDP)) which accounts for 70% of its total GERD. Large domestic firms are the key actors; SMEs account for 17% of Business Expenditure on R&D (BERD) and foreign affiliates for 15%.

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[62] http://www.eda.gov/funding-opportunities/

[63] http://www.oecd.org/sti/outlook/e-outlook/sticountryprofiles/unitedstates.htm

[64] http://www.oecd.org/sti/outlook/e-outlook/sticountryprofiles/unitedstates.htm

[65] "A Strategy for American Innovation". White House, 2011, http://www.whitehouse.gov/sites/default/files/uploads/InnovationStrategy.pdf

[66] The **H-1B** is a non-immigrant visa in the United States under the Immigration and Nationality Act, section 101(a) (15) (H). It allows U.S. employers to temporarily employ foreign workers in specialty occupations. If a foreign worker in H-1B status quits or is dismissed from the sponsoring employer, the worker must either apply for and be granted a change of status to another non-immigrant status, find another employer (subject to application for adjustment of status and/or change of visa), or leave the U.S.

The regulations define a "specialty occupation" as requiring theoretical and practical application of a body of highly specialized knowledge in a field of human endeavour including but not limited to biotechnology, chemistry, architecture, engineering, mathematics, physical sciences, social sciences, medicine and health, education, law, accounting, business specialties, theology, and the arts, and requiring the attainment of a bachelor's degree or its equivalent as a minimum (with the exception of fashion models, who must be "of distinguished merit and ability"). Likewise, the foreign worker must possess at least a bachelor's degree or its equivalent and state licensure, if required to practice in that field. H-1B work-authorization is strictly limited to employment by the sponsoring employer. (Source: Wikipedia - http://en.wikipedia.org/wiki/H-1B_visa)

[67] STEM is the acronym standing for Science, Technology, Research and Mathematics.

[68] K-16: **K-16** refers to a movement in the United States to bring together the various levels of education for younger students, namely between the K-12 (primary and secondary education) and the post-secondary education systems, and create aligned policy and practice in examination practices, graduation requirements, admissions policies and other areas. The movement is so-named because of an insinuated continuum between the traditionally-distinct K-12 system and the two-to-four-year basic post-secondary education system that is in place in most colleges and universities (hence "13th grade", "14th grade", "15th grade" and "16th grade").

Most private R&D performers are in high-technology manufacturing (50%), followed by knowledge-intensive services (27%). Triadic patents per GDP are above the OECD median.

Researchers' international linkages are below the OECD median on account of the variety of opportunities offered by domestic linkages: 30% of scientific articles and 12% of Patent Cooperation Treaty (PCT) patent applications involve international collaboration.

"Universities and Public Research Institutes (PRIs) are actively filing patents, especially in bio- and nanotechnologies (35%). It has a good skills foundation; 41% of the adult population is tertiary-qualified and 35% of those employed are in S&T occupations. Inflows of new skills are modest. There is a relative decline in doctoral graduates and low participation in science and engineering". [69] In fact, the cooperative definition of standards is another field of potential U.S. - EU innovation cooperation. The lack of uniform international standards can result in limiting the economic opportunities of companies with superior technologies because a multiplicity of standards can effectively result in a multiplicity of fragmented markets, the perspective of which often hinders investment into innovative technologies.

2.1 U.S. Innovation Policy System[70]

The U.S. has a large and decentralized innovation system, with a quite dynamic structure at both the federal and state level. Despite the state driven dynamics for innovation, the U.S. innovation system has several policy making points, including the Executive Office of the President and Congress.

There is no central administration exclusively in charge of innovation. The Office of Science and Technology Policy (OSTP) provides policy advice and coordinates STI policies. Federal agencies receive funds for research that align with their individual missions. These agencies designate research funds for intramural (internal) and extramural (external) programs that are competitively won by universities, non-profit research organizations, and small businesses. The majority of these funds go to agencies within the Department of Defense (Army, Navy, Air Force, and a collection of other defense agencies) to ensure a continued strong national defense system. Focusing on budgetary details for the Financial Year 2015 the House via the appropriations Committee has designated a total of $65,969 millions for the Department of Defense R&D[71]. In fact the estimated distribution of R&D by agency in FY 2014 by budget authority shows that about 48.7% is allocated to the Department of Defense, 22.7% to the National Institutes of Health and 8.4% to the Office of Science in the Department of Energy. NASA receives also about 8.5%[72]. The Defense Advanced Research Projects Agency (DARPA) is known as a nimble and disruptive innovation program which invests in unconventional ideas and has been credited with the advancement of the Internet to its current success. In fact DARPA has produced an unparalleled number of breakthroughs and innovations including the internet; RISC computing; global positioning satellites; stealth technology; unmanned aerial vehicles, or "drones"; and micro-electro-mechanical systems (MEMS), which are now used in everything from air bags to ink-jet printers to video games like the Wii. Although the U.S. military was the original customer for DARPA's applications, the agency's advances have played a central role in creating a host of multibillion-dollar industries[73]. DARPA has become a model that other federal agencies are modeling their programs after, such as the Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E). According to a recent study of 2012[74] the

[69] The Innovation Policy Platform: https://innovationpolicyplatform.org/content/united-states

[70] INNO Policy TrendChart: Mini Country Report/United States of America: http://ec.europa.eu/enterprise/policies/innovation/files/countryreports/usa_en.pdf

[71] http://www.aaas.org/sites/default/files/DOD%2015hc%20Table%202.jpg

[72] Federal R&D Budget Trends: A Short Summary (2015). http://www.aaas.org/news/primer-recent-trends-federal-rd-budgets

[73] https://hbr.org/2013/10/special-forces-innovation-how-darpa-attacks-problems/ar/

[74] The study was sponsored by TechLink a US Department of Defense (DoD) Partnership Intermediary based at Montana State University, Bozeman. Due to the fact that TechLink facilitated approximately 40 percent of DoD's license agreements with industry during the period analyzed, the study represents a substantial case

Nationwide economic contribution resulting from DoD technology transfer agreements, facilitated by TechLink, in the period 2000-2011, total economy-wide sales, as measured by output, were estimated at $2.935 billion. In the same time value added was estimated at $1.553 billion, representing new wealth creation in the economy. Employment impacts included 17,818 jobs with an average wage of $59,000. Moreover the Labor income in 2011 was estimated at $1.049 billion and a $1 billion in sales and its economy-wide effects generated (in 2011) approximately $217 million in federal tax revenues and over $114 million in state and local tax revenues.

The Advanced Research Projects Agency-Energy (ARPA-E) catalyzes transformational energy technologies that could create a more secure and affordable American future by advancing high-potential, high-impact energy technologies that are too early for private sector or other DOE applied research and development investment and focuses on energy technologies that can be meaningfully advanced with a small investment over a defined period of time. Like DARPA does for military technology, ARPA-E is intended to fund high-risk, high-reward research that might not otherwise be pursued because there is a relatively high risk of failure. ARPA-E awards are selected through two models: “focused” programs, which address a specific energy challenge; and “open” solicitations, which seek applications for any idea that has the potential to produce game-changing breakthroughs in energy technology. ARPA-E encourages interdisciplinary thinking for both “open” solicitations and “focused” programs by recommending the use of a diverse combination of skills and partners that can approach challenges in new ways. ARPA-E “focused” programs provide a unique bridge from basic science to early stage technology. These programs draw from the latest scientific discoveries and envision a viable path to commercial implementation through firm grounding in the economic realities and changing dynamics of the marketplace.

The programs created through solicitations cover a wide range of technical areas, including electric vehicle energy storage systems, light-metal processing and recycling, biological gas-to-liquids conversion, high-efficiency transistors, and hybrid designs for solar power generation. As of February 2014, ARPA-E has invested over $900 million across 362 projects through 18 focused programs and two open funding solicitations (OPEN 2009 and OPEN 2012)[75]. To date, 22 ARPA-E projects have attracted more than $625 million in private-sector follow-on funding after ARPA-E’s investment of approximately $95 million[76]. In addition, at least 24 ARPA-E project teams have formed new companies to advance their technologies, more than 16 ARPA-E projects have partnered with other government agencies for further development, and at least 4 technologies funded by ARPA-E are in preliminary commercial sales.

Other agencies receiving a majority of the research funds include the National Institutes of Health, the Department of Energy and the National Aeronautics and Space Administration. In all, there are 26 different grant-making agencies[77] with over 900 grant programs.

The U.S. Department of Commerce with its non-regulatory agency National Institute of Standards and Technology (NIST) which has as mission to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life, and the U.S. Patent and Trademark Office play a key role in facilitating innovation. Long-standing technology transfer policies starting with the Bayh-Dole Act in 1980, and subsequent acts have been essential in the U.S.’ ability to move research and technology developed with federal funds into the market. The Bayh-Dole act gave the rights of intellectual property developed with U.S. federal funds to the universities, non-profit research organizations, and small businesses that developed it.

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study of the economic outcomes and impacts resulting from Department of Defense technology transfer. http://www.nist.gov/tpo/publications/upload/TechLink_Economic_Impact_Report_2012.pdf

[75] Advanced Research Projects Agency – Energy Annual Report for FY2013 Report to Congress, April 2014 http://arpa-e.energy.gov/sites/default/files/EXEC-2013-006744%20Final%20signed%20report.pdf

[76] Advanced Research Projects Agency FY15 budget request http://arpa-e.energy.gov/sites/default/files/ARPA-E%20FY15%20Budget%20Request.pdf

[77] http://www.grants.gov/web/grants/applicants/applicant-resources/agencies-providing-grants.html

The Federal Laboratory Consortium for Technology Transfer (FLC)[78] is also a major player offering opportunities for linking laboratory mission technologies and expertise with the marketplace. The FLC is the nationwide network of federal laboratories, typically technology transfer offices, that provides the forum to develop strategies since 1986 (when it was formally chartered by the Federal Technology Transfer Act). Its core aim is to promote and strengthen technology transfer nationwide. NIST is required by law to collect metrics on all of the federal laboratory technology transfer activities and present a report to Congress. In the latest available report published in 2013[79] referring to the Fiscal Year 2011 the she statistical data provided indicate that over the five-year span from 2007 through 2011, Cooperative Research and Development Agreement collaborations with Federal laboratories increased somewhat, corresponding to a small upward growth. Over the period from Fiscal Year 2007 through Fiscal Year 2010 Invention disclosures, patent applications filed, and patents issued remained steady, followed by significant increases in Fiscal Year 2011. Whereas, licensing activity showed an increasing trend between 2007 and 2011; however, licensing revenue remained relatively flat over the same period.

The Small Business Innovation Research (SBIR) program and its counterpart, the Small Business Technology Transfer (STTR) program focuses on providing research, development, and innovation funds exclusively to small businesses. Agencies with a research budget of at least $100M are required to establish these programs with 2.8% of their R&D budgets, and consequently there are 12 different SBIR programs run by the agencies themselves, and loosely coordinated by the Small Business Administration[80]. In the last 10 years several agency-run commercialization support programs were created to assist companies with SBIR projects to ease their way into a market, whether it is back into the agency's procurement programs as is often done in the Department of Defense agencies as a type of pre-commercial procurement, or into the commercial market.

The America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act of 2007 (COMPETES) had as aim "to invest in innovation through research and development, and to improve the competitiveness of the United States."[81] The Act covered a wide range of activities of a great number of federal agencies and offices including the Office of Science and Technology Policy, the National Aeronautics and Space Administration, the National Institute of Standards and Technology, the National Oceanic and Atmospheric Administration, the Department of Energy and the National Science Foundation. In many places, the Act mandated that each agency cooperate with its partner agencies and offices, and it calls attention to the importance of high-risk, high-reward research in areas of critical national need. Innovation policy priorities in the U.S. have shifted along with the latest economic changes following the crisis. In 2009, innovation policy priorities were part of a broad-based investment environment aimed to stimulate recovery from the economic crisis; since 2011, they exist in an environment that promotes greater attention to reducing the federal deficit and "rebalancing" the economy, while also making selective investments to incentivize job growth and innovation. It is also worthwhile mentioning that the ARRA/U.S. Stimulus package had included investments directly targeted to clean energy development.

This change in the priorities is made clear in the re-shaping of the America COMPETES Act in 2010. Reflecting the changed economic situation, the Act continued to support doubling the research budgets of targeted physical science agencies, but over a longer timeframe. It also allowed agencies to administer prizes for stimulating innovation, rather than solely relying on selected grant programs.

The U.S. has made other selective investments to promote innovation and job growth at the sub-national level. The administration has instituted several new multi-agency regional innovation cluster programs, to enhance the innovation ecosystem of localized targeted industry sectors. The administration also has developed an initiative – Startup America – to stimulate entrepreneurship. Measurement of the impact of these investments still remains critical and concern about the

[78] http://www.federallabs.org/
[79] http://www.nist.gov/tpo/publications/federal-laboratory-techtransfer-reports.cfm
[80] http://www.sbir.gov/about/about-sbir
[81] http://www.gpo.gov/fdsys/pkg/PLAW-110publ69/pdf/PLAW-110publ69.pdf

competitive position of the U.S. continues to be expressed. This concern is seen for example in the 2010 release of the “Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5” report, which updates an earlier influential report issued in 2005.

U.S. financial and budgetary issues have led to a lesser emphasis on direct financial support. New support measures are currently being promoted, although at lower levels than might otherwise be the case in a different economic climate.

With regards to evaluations of innovation policies, the National Academy of Sciences updated its 2005 influential report, Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future in a new report which was released in 2010. This updated report, Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5 indicated that the U.S. is in a worse position than it was when the 2005 report was released. The primary and secondary educational system and under-investment in science were highlighted as calling for substantially greater attention.[82]

In February 2011, “A Strategy for American Innovation”[83] was published, detailing how the Administration, the American people, and American businesses can work together to strengthen the long-run economic growth and identifying three critical areas: 1) Investing in the Building Blocks of American Innovation, 2) Promoting Market-Based Innovation, 3) Catalyzing Breakthroughs for National Priorities

In July 2013, a COMPETES progress report provided findings on basic research, education, research infrastructure, and support for manufacturing. The National Science Foundation’s[84] (NSF) Science of Science and Innovation Policy (SciSIP) and Science of Science Policy (SOSP) are building a knowledge base in order to improve policy evaluation, but most important, they invest in the R&D seedbed for innovation. The United States Government Accountability Office, Report to Congressional Committees[85] of July 2013 indicates that in fiscal years 2008-2012, $52.4 billion was appropriated out of the $62.2 billion authorized under the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act of 2007 (COMPETES 2007) and the America COMPETES Reauthorization Act of 2010 (COMPETES 2010). Almost all of these funds went to the entire budgets of three existing research entities—the National Science Foundation (NSF) (64% $33.2 billion), the National Institute of Standards and Technology (NIST) (8% $3.9 billion), and the Department of Energy’s (DOE) Office of Science (Science) (28% $14.6 billion)—including all of the programs and activities the entities carry out. Appropriations for NSF, NIST, and Science generally increased under the acts but did not reach levels authorized by the acts. In addition to authorizing the budgets of these entities, COMPETES 2007 and COMPETES 2010 specifically authorized funding for 40 individual programs, including some programs within and some outside of these entities. Among those 40 programs, the 12 programs that existed before COMPETES 2007 received appropriations and continued to operate. Six of 28 newly authorized programs were also funded. Of these 6 programs, 1—DOE’s Advanced Research Projects Agency-Energy, set up to develop new energy technologies—is continuing operations, 3 were not funded in fiscal year 2012, and 2 were not fully implemented as of May 2013. For the 22 programs that were not funded, agency officials generally said that they did not request funding in their budget submissions; most often this was because agencies had similar programs under way or could pursue similar objectives within current programs. For example, Science said it did not request funding for the Discovery Science and Engineering Innovation Institutes because it would have duplicated other Science programs. For the fully implemented programs for which the COMPETES Acts specifically authorized funding, recent

[82] National Academy of Sciences (2010). Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5. Washington DC: National Academies Press.
[83] White House, 2011, http://www.whitehouse.gov/sites/default/files/uploads/InnovationStrategy.pdf
[84] The NSF is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense”. With an annual budget of $7.3 billion (FY 2015), it is the funding source for approximately 24 percent of all federally supported basic research conducted by America's colleges and universities. http://www.nsf.gov/about/
[85] http://www.gao.gov/assets/660/656019.pdf

evaluations generally reported positive results, and some evaluations provided suggestions for improvements. Recent evaluations have been conducted for almost all of the programs that were implemented, or for aspects of those programs. For example, studies of the Robert Noyce Teacher Scholarship Program found that the program has increased the number of qualified science, technology, engineering, and mathematics (STEM) teachers, but also suggested that retention of teachers in high-need schools could be improved.

The COMPETES Act of 2010 has since expired, and the U.S. government is working on several versions of a bill to replace it[86]. The newly elected Congress in 2014 could see the reauthorization of the America COMPETES Act. In fact, there are four COMPETES bills and hence, the outlook for the most recent iterations of the bill is uncertain. The House Republicans initially split the legislation into two separate bills (the FIRST Act and the EINSTEIN Act). The Frontiers in Innovation, Research, Science, and Technology Act (FIRST Act, H.R. 4186) proposed a two-year reauthorization (FY 2014-FY 2015) for the National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST) with both agencies receiving a 1.5 percent increase in FY 2015. Whereas, the Enabling Innovation for Science, Technology, and Energy in America Act (EINSTEIN Act) reauthorized the Department of Energy's Office of Science (OSC) but not the Advanced Research Projects Agency-Energy (ARPA-E) which was created under the 2007 COMPETES bill. In the same time the House Democrats and the Senate) proposed their own versions. The House Democrats' bill (H.R. 4159) reauthorizes NSF, NIST, and DOE OSC, and focuses on four goals: supporting research, fostering innovation, creating jobs, and improving science, technology, engineering, and mathematics (STEM) education. In order to support research and foster innovation, the bill would increase funding for the three agencies by 5 percent year by year, and it would reauthorize the National Nanotechnology Initiative, ARPA-E, a Regional Innovation Program, and Innovation Hubs run by DOE. It would also establish the Federal Acceleration of State Technology Commercialization program in order to "advance United States productivity and global competitiveness by accelerating commercialization of innovative technology by leveraging Federal support for State commercialization efforts." On its turn the Senate bill (S. 2757) reauthorizes NSF and NIST from FY 2015-FY 2019, but excludes DOE which is not within the jurisdiction of the Senate Commerce, Science, and Transportation Committee. The bill would provide annual increases for both agencies at 6.7 percent which would result in significant growth. Other goals include: improving STEM education, supporting NSF's social, behavioral, and economic sciences (SBE) directorate, reducing administrative burdens for government researchers, maintaining attendance at science conferences, and supporting NSF's merit review process.

Innovation policy plays a large role at the state level as state governments and universities take a prominent role in driving innovation at the sub-national level. This reflects the long-standing practice in the U.S. of economic development policy, in general, being generated and executed at the sub-national level. In fact states are often looked to as "policy laboratories" whereby policies are tested and best practices scaled across states as they are proven. Still there are plenty of national and global corporations within the states that work across policy environments to meet their needs. As Rob Atkinson mentions in his description of the overall innovation policy system in the ITIF report[87] "there is no national, coordinated innovation policy system in the United States. While some nations have developed national innovation strategies (e.g., Germany, Sweden, and Finland), the United States generally has not. This reflects in part a belief that innovation is best left to the market and that the role of government, to the extent there is one, is to support "factor inputs" such as knowledge creation and education" [88]. Thus, whereas the U.S. system focuses on market-driven innovation, the Europeans direct the innovation system towards certain goals. This is an element that should be discussed as part of a future S&T cooperation with the intention that the implications of the

[86] http://www.aaas.org/news/future-uncertain-competes-legislation

[87] Rob Atkinson, "Understanding the U.S. National Innovation System", The Information Technology & Innovation Foundation (ITIF), http://www2.itif.org/2014-understanding-us-innovation-system.pdf

[88] Rob Atkinson, "Understanding the U.S. National Innovation System", The Information Technology & Innovation Foundation (ITIF), http://www2.itif.org/2014-understanding-us-innovation-system.pdf

difference in the approach towards innovation are understood since this might have implications also on the form of cooperation agreements.

The U.S. has a diverse private industry including large multinationals, mature industries, and high tech and knowledge-based start-ups. The U.S. innovation system also includes private non-profit policymaking, advocacy, research, technology transfer companies and public-private partnerships to help network and coordinate innovation ecosystems. Venture and risk capital organizations are important sources for financing. Universities serve not only as sources of innovative ideas, but they also assist and administer the innovation processes (i.e. technology transfer, incubation and spin-off, and innovation policy). Moreover, networks of public-private partnerships, incubators, accelerators and an emergence of innovation districts in addition to science and technology parks further embed innovation within a web of supportive institutions.

Since 2009, several new governance systems related to innovation have been created by the federal government. The most important ones are:

- **Startup America Partnership**, a federal government-initiated (under the Startup America umbrella) private non-profit organization. The aim of the organization is to coordinate private entrepreneurship assistance, services, and financing. The program engages with state regions – Startup Tennessee for example – in addition to its national scope.[89]
- **Office of Innovation and Entrepreneurship,** a unit within the Department of Commerce, which carries out and coordinates innovation-related initiatives and programs.[90]
- **The National Advisory Council on Innovation and Entrepreneurship** (NACIE). NACIE comprises of executives from large corporations, high-tech start-up firms and university presidents that provide counseling on innovation and new firm policy issues to the Secretary of Commerce.[91]
- **Science and Technology in America's Reinvestment** – Measuring the Effect of Research on Innovation, Competitiveness and Science (STAR METRICS). STAR METRICS is a multi-agency initiative, aiming to create an infrastructure for the collection and monitoring of research and innovation measures and for assessing economic, workforce, scientific and social outcomes.[92]
- **National Network for Manufacturing of Innovation (NNMI) –** the measure is coordinated by the newly established Advanced Manufacturing National Program Office. The Network consists of regional hubs that are aimed for accelerating development and adoption of cutting-edge manufacturing technologies for making new, globally competitive products. Over the last two years, four innovation hubs have been established and four more are currently being initiated. The hubs have the form of public-private partnerships that focus on specific technology topics in innovation, including additive manufacturing, power electronics, digital design and manufacturing, lightweight and modern metals, photonics, and composites. These hubs use the public-private-partnership model where seed funding provided by the sponsoring agency (Department of Defense and Department of Energy so far) is matched by the private industry, states, universities, and other member organizations.
- **National Institute of Standards and Technology's (NIST) Hollings Manufacturing Extension Partnership (MEP)**[93] - a U.S.-wide network of 60 centers provides support to the small and medium-sized U.S. manufacturers to help them create and retain jobs, increase profits, and save time and money. Most of the centers are co-funded by the states that they reside in and by the fees that they charge SMEs for their services. While not a new program, the MEP program's strategic goals changed in 2009 to broader its scope to include the provision of innovation services to SMEs to help them grow.

89 www.startupamericapartnership.org
90 http://www.eda.gov/OIE
91 http://www.eda.gov/NACIE
92 http://sites.nationalacademies.org/PGA/fdp/PGA_057189
93 http://www.nist.gov/mep/

- **DoE's set of Energy Innovation Hubs** were modeled after the strong scientific management characteristics of the Manhattan Project and AT&T Bell Laboratories. The Energy Department's Energy Innovation Hubs are integrated research centers that combine basic and applied research with engineering to accelerate scientific discovery that addresses critical energy issues. The Hubs were first established in 2010 with the creation of the Consortium for Advanced Simulation of Light Water Reactors (current Nuclear Energy Modeling & Simulation Hub), which focuses on improving nuclear reactors through computer-based modeling. In total, there are currently four Hubs (including the one indicated above) that work from advancing research to produce fuels directly from sunlight (the Joint Center for Artificial Photosynthesis) to improving battery technology for transportation and the grid (the Joint Center for Energy Storage Research) to developing solutions for rare earth elements and other materials critical to a growing number of clean energy technologies (the Critical Materials Institute).

These initiatives reveal an institutional set-up, which involves public agencies and a private-non-profit foundation which are all linked with universities, federal labs, research institutes and business. Policy coordination takes place primarily through the White House. Key stakeholders apart from the White House include the Small Business Administration, Department of Commerce, and Case and Kauffman Foundations for the entrepreneurship initiatives (Startup America, Office of Innovation and Entrepreneurship, NACIE[94]) as well as the OSTP[95], NSF[96], and NIH[97] for the STAR METRICS initiative (see below).

Priority setting can either follow a bottom-up approach by the respective agencies and foundations or a top-down approach where a state or federal agency outlines broad agendas and then tasks the agency to develop priorities and strategies to meet the broader agenda; Program evaluation is often funded by the agencies themselves, and they hire organizations such as the National Academies, non-profit research institutions, or universities to perform them. The Congressional Research Service and Office of Management and Budget provide program analysis to inform Congress. Sub-national initiatives are typically evaluated at the subnational level, paid for by program funders such as state agencies and private foundations to determine the value and effectiveness of the programs. On the whole it is important to remember that in the U.S., the approach to regional innovation is fluid, dynamic and often characterized by a hybridized approach. Processes and functions frequently fall outside of classifications or standard processes depending on the region and the agency involved.

2.1.1 Key Innovation priorities

U.S. innovation measures address a range of policies. About 30% reflect strategic policies aiming to involve society-driven innovation, strategic research policies, or policy advisory services or strategies. Another roughly 30% address research infrastructures, R&D cooperation, or R&D grants. Nearly 25% of the policies address human capital issues (i.e. science education, relationship between teaching and research, stimulation of doctoral degree holders and incentives for recruiting researchers). There are only a few policies dealing directly with fiscal incentives and risk capital while there is **only one** directly dealing with the use of innovative standards. Again, this is reflecting that most innovation policy is really driven and implemented at the state and local level.

The American Recovery and Reinvestment Act of 2009 and the America COMPETES Act have generated a number of specific measures. For example, America COMPETES Act of 2007 established the Advanced Research Projects Agency-Energy (ARPA-E) presented earlier. Similarly, the Manufacturing Extension Partnership (MEP) program has implemented the program design

[94] NACIE: National Advisory Council on Innovation and Entrepreneurship
[95] Office of Science and Technology Policy: http://www.whitehouse.gov/administration/eop/ostp
[96] National Science Foundation: http://www.nsf.gov/
[97] National Institutes of Health: http://www.nih.gov/

stipulations specified in the Act concerning the creation of new centers, centers' evaluations, and advisory board composition. These measures are expected to address a number of diverse target groups:

- Nearly 25% of the measures directly address individual firms, through serving as a funding source or providing technical assistance.
- About 20% of the measures emphasize cooperation and partnerships.

In general, measures promoting cluster initiatives are quite new at the federal level while they have been used for decades at the state level. At the federal level the Obama Administration has embraced clusters as a way to spur the economy[98], so funding activity for clusters through the federal government (SBA, EDA, cross-agency initiatives) has increased over the last 6 years. Furthermore, a Cluster Mapping initiative, that provides open data on regional clusters and economies to support U.S. business, innovation and policy through a website (http://clustermapping.us/), allowing user to find interactive, robust data and tools to understand clusters and regional business environments, improve institutions and locate appropriate partners across the country.

At the same time policies directly targeting the energy and health information technology sectors are borne in part out of the American Recovery and Reinvestment Act. Nine out of ten measures are grant programs. The remaining measures place emphasis on non-direct funding through tax credits or implementation of standards.

The current administration has initiated several cross-agency programs over the past years to foster greater linkage between research and innovation policy across disciplines and markets including initiatives for energy and in 2011-2013 supporting advanced manufacturing. For example, to this end, three advanced manufacturing institutes as part of the National Network for Manufacturing Innovation were planned for 2013, as well as Manufacturing Technology Acceleration Centers, and a community-level program investing in partnerships between manufacturing, government, and universities.[99]

In terms of priority areas, nearly 40% of these programs are focused on development of ideas and transfer of these ideas into the market. About half of these commercialization-oriented measures provide financing and the other half stress the creation of cooperative networks involving companies and universities. Some 20% of the measures address social innovation goals such as society-driven challenges, capability development to foster greater equality in receipt of federal R&D funds between the states, and greater understanding of informal and formal societal environments for encouraging learning. One measure – the National Science Foundation's Science of Science and Innovation Policy (SciSIP) – furthers public sector innovation by stimulating research to understand the kinds of outcomes that can be expected from scientific investments. Creativity is advanced in award programs that recognize highly creative research, which comprise fourteen per cent of the measures including the National Institute of Health's Transformative R01 awards, National Institute of Health's Director's Pioneer Awards, and the National Science Foundation's Faculty Early Career Development Program. Services innovation is not directly represented in the U.S. innovation policy mix, although energy and health information technology policies in the American Recovery and Reinvestment Act stimulate the need for innovative services in these areas.

[98] National Economic Council, Council of Economic Advisers, and Office of Science and Technology Policy (2011) "A Strategy for American Innovation". White House

[99] http://erawatch.jrc.ec.europa.eu/erawatch/opencms/search/advance-search.html?tab=reports&country=us#listado

2.1.2 Latest policy measures[100]

Below follows a more detailed presentation of the key U.S. innovation support measures at the national level. It is important to remember that there are hundreds if not thousands of tailored and specific policies for states, cities and regions.[101]

Multi-agency managed programs

Health Information Technology for Economic and Clinical Health (HITECH)

This measure addresses health care issues through the creation of a health information technology system. This system has the purpose of not only contributing to the acceleration of economic recovery, but even more so, of promoting enhanced health care through the creation of an infrastructure for the support of medical records sharing and distributed health care alternatives.

Against the backdrop of the economic downturn and efforts to stimulate recovery, there has been a long national debate about U.S. health care system issues. One of these issues is the cost of the health care delivery system and speed at which important medical information is shared. These issues have not been able to be addressed because of the costs of developing interoperable systems, setting standards for information storage and dissemination, and adequately addressing privacy and security of personal medical records. HITECH addresses this debate by providing for investments in information technology infrastructure and standards setting.

This measure targets the health care and ICT fields and is inspired by the national policy debate about the use of public investments in infrastructure (in this case health care) as one policy approach for addressing the economic downturn and stimulating economic activity. Multiple proposals from a single individual within an eligible public or private organization may be submitted. The program is implemented through a combination of incentive payments to hospitals and medical institutions along with supporting programs to encourage these medical service delivery organizations to adopt electronic medical records.

This is a cross-unit effort within the U.S. Department of Health and Human Services. The program is managed under the auspices of a National Coordinator for Health Information Technology within the U.S. Department of Health and Human Services. A health information technology extension service solicitation was awarded to regional extension centers in 2010. State health information exchange programs also received funding in that year, as did education, training, and curriculum development centers. The selection criteria include the expertise of the applicants and its regional coverage. This program is not opened to EU countries. However, consideration is given to the involvement of non-U.S. participants if their special talents are not readily available in the U.S. This program is not opened to third countries outside of the U.S. However, consideration is given to the involvement of non-U.S. participants if their special talents are not readily available in the U.S. The selection process is based on a request for proposals that is advertised. The proposals then undergo review, are scored, and the top scoring proposals are selected.

Science and Technology in America's Reinvestment – Measuring the Effect of Research on Innovation, Competitiveness and Science

STAR METRICS is a multi-agency partnership among federal government science agencies and research institutes. Its objective is to develop an empirical framework to measure the outcomes of science investment and demonstrate the benefits of scientific investment to the public. The project is led by the National Institute of Health (NIH) and the National Science Foundation (NSF) under the direction of the Office of Science and Technology Policy (OSTP).

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[100] INNO Policy TrendChart: Mini Country Report/United States of America: http://ec.europa.eu/enterprise/policies/innovation/files/countryreports/usa_en.pdf

[101] European Inventory of Research and Innovation Policy Measures, accessed via the ERAWATCH platform: http://erawatch.jrc.ec.europa.eu/erawatch/opencms/research_and_innovation/ (accessed May 2014).

STAR METRICS is created in directed response to the reporting requirements of the American Recovery and Reinvestment Act (ARRA). It is also in direct response to the White House Office of Management and Budget (OMB) and Office of Science and Technology Policy (OSTP) request that federal agencies develop outcome-oriented goals for their science and technology activities.

The priority of STAR METRICS is to create a data infrastructure that systematically associates science funding with economic, scientific, and social outcomes. It also aims to construct systems to engage the public with scientific funding.

This measure aims at creating data infrastructure for evaluating scientific funding, but it does not target any specific research and technology fields.

All research institutes and federal agencies have the ability to use the data infrastructure created by this measure to quickly respond to State, Congressional, and OMB request.

STAR METRICS is implemented as a multi-phase project that evolves with time in response to the demand of federal agencies, research institutes and the general public. There are two phases planned:

- Phase I: Built upon the STAR Pilot project, the project develops uniform, standardized, and auditable measures of the initial impact of ARRA and science spending on job creation, using data from research institutions' existing database records.
- Phase II: The collaborative development of measures of the impact of federal science investment in four broad categories:
  - Economic growth (through patents, firm start-ups and other measures)
  - Workforce outcomes (through student mobility and employment)
  - Scientific knowledge (such as publications and citations) and, later,
  - Social outcomes (such as health and environment).

The project developed a six-step procedure to collaborate with research institutes in generating measures and reports in Phase I.

- Step 1: The project approaches voluntary research institutions for initial meeting.
- Step 2: The research institution indicates participation by signing a memorandum of understanding (MOU).
- Step 3: Research institutions are asked to provide sample data from their administrative systems housing data on human resources, indirect costs, vendors, and sub-awards.
- Step 4: The STAR METRICS team analyses the data, providing feedback to the research institutions and generating reports on job creation, retention, and changes from the previous quarter.
- Step 5: After the research institution receives confirmation that sample submissions are in the correct format, the research institutions are then asked to send recent and historical data.
- Step 6: After the information has been loaded into the STAR METRICS database, the STAR METRICS team create both quarterly reports and maps. These reports and maps are delivered to the research institution for their review and comment.

The project is managed as a collaborative initiative between the STAR METRICS team and participating research institutions.

Institutions in EU countries are not eligible to participate in this program.

Experimental Program to Stimulate Competitive Research (EPSCoR)

The Experimental Program to Stimulate Competitive Research (EPSCoR) was established to target U.S. states and territories that with a lower innovation and R&D performance. EPSCoR requires U.S. states and territories to engage in partnerships with local universities, industry, governments, and participating federal R&D funding agencies. EPSCoR encourages dedication to improving the level of science and engineering research conducted at local universities and colleges in EPSCoR states and regions. The program was first created at the National Science Foundation. Subsequently, other federal agencies have developed EPSCoR type R&D programs, including the Environmental Protection Agency (EPA), the Department of Energy (DoE), the National Aeronautics and Space Administration (NASA), the National Institutes of Health (NIH), the Department of Defense, and the Department of Agriculture. When NSF was created in 1950, its authorizing legislation required that the agency avoid geographic concentration of federal R&D. Congress expressed concern about a clustering of federal R&D that had occurred in a set of states, and in 1978 authorized NSF to formulate the EPSCoR program. The program was not conceived of as a special set aside for certain states. Rather it was designed to enable these U.S. states and territories, which historically received smaller amounts of federal R&D, to become more competitive in science, technology, engineering, and mathematics research at local universities and colleges. The key policy priority of EPSCoR is to achieve increased academic R&D regional balance.

Congress was worried that most of the poorest states in the U.S. received only a tiny percentage of the federal R&D budget and this proportion was not commensurate with their population size. It was determined that these states lacked the research infrastructure and local support to be competitive in research solicitations. Hence, the EPSCoR program was oriented around stimulation of local and state partnerships to encourage interest in strengthening of regional scientific and technological resources. Twenty-five U.S. states, the U.S. Virgin Islands, and the Commonwealth of Puerto Rico currently participate in the program. Eligible U.S. states include: Alabama, Alaska, Arkansas, Delaware, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Hampshire, North Dakota, Oklahoma, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, West Virginia, and Wyoming. An EPSCoR request may include support for state, profit, and non-profit organizations (and employees therein). Principal investigators of EPSCoR projects must be affiliated with research universities, agencies, and or organizations within an EPSCoR-eligible state.

NSF advertises calls for proposals in particular substantive areas. Proposals are submitted to NSF, which then administers a peer review process to make final selections of grant awardees. Proposals may include the names of potential reviewers with expertise in the substantive area of the proposed project. Reviewers are selected by program officers charged with the oversight of the review process. Proposals are reviewed on the basis of the intellectual merit of the proposed activity, the broader impacts of the proposed activity, integration of research and education, and the likelihood that proposed improvements will enhance research competitiveness. Other selection criteria may be added depending on the specific solicitation.

In preparing to submit a proposal, an EPSCoR steering committee within each eligible state undertakes a comprehensive analysis of the strengths and opportunities for developing its research institutions in support of the state's overall R&D objectives.

EPSCoR applies the following strategies: (1) supports research investigators in states with the lowest share of R&D funds per scientist and population; (2) excludes, even in these states, proposals rated "excellent" and thus already considered competitive according to NSF's traditional peer review rating system; (3) supports research projects and explicit capacity-building strategies aimed at increasing the research competitiveness of the whole state (the capacity-building aspect has been considered important because of the long-term expectation of increased research funding beyond support from the EPSCoR program itself); and (4) supports groups of related research projects within and across universities (research clusters)--rather than single investigators--as a means of promoting long-term, sustainable increases in institutional research competitiveness. This program is not open to EU countries.

Technology Innovation Program (TIP)

TIP program was designed to strengthen the framework for innovation by providing funding for high risk research projects critical to the nation's competitiveness and in areas that were not fully addressed through other funding mechanisms. TIP was a replacement for the former Advanced Technology Program (ATP). The ATP program had been eliminated in the budget under the Bush

Administration. Title III of the America COMPETES Act reconstituted ATP as TIP with a more narrowly circumscribed mission and operational domain.

The measure was inspired by several national level studies of the importance of enhancing the U.S. national innovation system to maintain global competitiveness, including the Council on Competitiveness report Innovate America published in 2005.

Title III of the America COMPETES Act is focused on small- and medium-sized enterprises (SMEs). The TIP program was revised, compared to the former ATP program, to focus on SMEs. The ATP program had included large corporations. Higher educational institutions are allowed to participate in TIP as partners with SMEs.

The program was organized within NIST, which is within the Department of Commerce and falls within the Industrial Technology Services of NIST, while it is a centrally-run grant program.

Rigorous progress reviews are in place in addition to the centrally run assessment mechanisms through the Office of Management and Budget's Program Assessment Rating Tool (PART). TIP gathered metrics to report into the PART system and used formal reviews of research proposals.

TIP was primarily a domestic program focused on small and medium-sized businesses with fewer than 500 employees. To receive funding, a company had to be incorporated in the U.S. and had to perform most of its business in the U.S. The parent of such a company may have been headquartered outside the U.S. Awards were selected according to the extent to which they met critical areas of national need, which were determined by the program and announced in program solicitations.

The TIP program was cancelled a few years ago. Both ATP and TIP were considered successful by some, but there were some members of Congress that did not support it. Opponents of the program considered it to be a “corporate welfare” program.

NSF programs

NSF Science of Science and Innovation Policy (SciSIP)

The Science of Science and Innovation Policy (SciSIP) program is administered by the Directorate for Social, Behavioral and Economic Sciences (SBE) of the National Science Foundation (NSF). The goal of the program is to support research that improves the ability to understand processes of science and engineering research, to evaluate returns from investments in science and engineering research, and to forecast the success of future science and engineering research projects. This is a new program that was inspired by a national debate about the effectiveness of investment in innovation and research projects. This program is part of a larger multi-agency initiative to address questions about the relationship between scientific developments and public policy decisions. This focus was partly spurred by former U.S. presidential science advisor, John Marburger, who has repeatedly drawn attention to the lack of empirical guidance for science policy decisions. The first program solicitation was issued in 2007. The emphasis areas are analytical tools, model building, and creation of publicly accessible databases.

This program prioritizes research into assessment of the effects of various investments in science and innovation. The program is thematically oriented towards the development and use of tools and methods to evaluate science policy. The program solicitation encourages interdisciplinary approaches that involve researchers from science and engineering disciplines and was set up as a response to the call for a more empirical basis for decisions about federal expenditure on science and innovation projects.

This program is administered through competitive grants. A public call for proposals is issued, and includes information about the specific thematic focus for that year's solicitation. For example, in 2007, the two areas of focus were analytical tools and model building. Grant proposals are evaluated through a peer review process, and some 20 awards are made. The amount of the grant varies between $50,000 and $400,000 in total costs for a maximum duration of three years.

The Division of Social and Economic Sciences within the Directorate for Social, Behavioral & Economic Sciences of NSF takes a leadership role in managing the program. The program is managed through yearly competitive grants through the Directorate for Social, Behavioral & Economic Sciences of NSF.

The selection criteria for this program follow the standard NSF criteria for peer-review selection. Proposals are evaluated on the basis of two main questions: (1) what is the intellectual merit of the proposed activity? (2) What are the broader impacts of the proposed activity? It is also standard for the NSF to consider the integration of research and education in the proposal as well as the integration of diversity. Review criteria that are unique to the SciSIP program include: (1) Fit to Science of Science and Innovation Policy (2) Multidisciplinarity and Interdisciplinarity, and, (3) Relevance to the program subthemes.

Third country, including EU participants, can only be included on proposals through sub-awards or as consultants.

The Industry/University Cooperative Research Centers (I/UCRCs)

The Industry/University Cooperative Research Centers (I/UCRCs) Program supports the creation of centers that represent a partnership among industry, academia, and government in targeted areas identified by an Industry Advisory Board. The centers receive funding from the National Science Foundation (NSF), which must be matched by other financial sources, particularly industry memberships in the centers. As of 2011 there are 55 active IUCRCs. More than 750 faculty researchers, along with some 750 graduate students and 200 undergraduate students, carry out the research at these centers, which work across a broad range of research and technology fields. NSF reports that IUCRCs have over 700 partners -- about 90 per cent are industrial firms; the remaining 10 per cent include state governments, national laboratories, and other federal agencies.

The I/UCRC Program addresses the need to strengthen applied research conducted by universities, build university-industry linkages to foster commercialization of academic research, provide industry input into research themes, and train students with university-industry research expertise.

I/UCRCs are designed to encourage industry-university research cooperation in the conduct of industrially-relevant research. The overall goal is to influence the R&D performance capacity of U.S. industry.

Research at the center encompasses almost the entire spectrum of current technological fields and there is no specific research theme.

The I/UCRC Program was inspired by a debate about the role of basic versus applied research in industrial innovation. The I/UCRC model grew out of a pilot program (The Experimental R&D Incentives Program) which operated from 1972 to about 1979. One approach that received sustained support from industry at the end of this program was an industry consortium focused on polymer processing at the Massachusetts Institute of Technology (MIT). This consortium became a model for the I/UCRCs.

The I/UCRC Program offers five-year awards to centers. After this five year period, centers that continue to meet the I/UCRC Program requirements may apply for a second five-year award. After ten years, the centers are expected to be completely supported by industrial, other federal agency, and state and local government partners. A center can re-compete for a new cycle after ten years only if the proposal involves significant new intellectual substance.

Centers are required to submit reports for evaluation. It is required that there is an independent evaluator who cannot be from the department within the institution receiving funding for the I/UCRC award. The center evaluator is responsible for: preparing an annual review of center activities with respect to industrial collaboration during the previous year (which is appended to the center's annual report to NSF); conducting a survey of all center participants using an instrument that is provided by NSF; compiling a set of quantitative indicators determined by NSF to analyze the management and operation of the center; participating in the Industry Advisory Board and any other relevant meetings; performing exit interviews to determine why members chose to withdraw from the center; and communicating information on the quality of the industry/university partnership to NSF and back to the center for continuous improvement.

Selection criteria for the I/UCRC Program include: development of a partnership among academic, industry and other organizations; consultation with center members to set a defined research agenda; equal sharing of the intellectual property developed by the center among members; monitoring and advisement on the progress of center research; program of university, industry, and other partners that are the primary financial resource for the center; a formal structure and policies for center members outlined in an I/UCRC membership agreement; graduate student involvement in high quality research projects; an interdisciplinary team of faculty and students that is diverse in gender, race, and ethnicity; a center director, based at the lead university; are search team capable of developing and operating a center; and formal evaluation conducted by an independent evaluator. I/UCRCs are restricted to U.S. academic institutions with research and graduate programs.

Engineering Research Centers Program (ERC)

The Engineering Research Centers (ERC) Program of the National Science Foundation (NSF) aims to provide support for multidisciplinary centers that foster collaboration between academia and industry in particular emerging subject areas defined by the center. ERCs also have a goal of exposing students to new interdisciplinary and business-oriented learning experiences. A further ERC goal is the transfer of technologies developed by the centers into the business sector. The ERCs emerged in response to global challenges to the competitive position of U.S. industry in the 1980s. These concerns related to the ability to innovate new products in industries such as electronics. However, they also related to the quality of the U.S. higher educational system. It was believed that U.S. engineering graduates lacked sufficient exposure to business practices to be able to be productive in industry without undergoing additional extensive training[102]. The key policy priorities of the ERCs include the integration of research and education, the linking of diverse science and engineering disciplines, and the enhancement of science and engineering graduates' ability to meet international competitiveness challenges. The major technological areas of the current ERCs focus are: biotechnology and healthcare, energy and sustainability, and microelectronics and information technology. The ERC program was inspired by a debate in the 1980s about how the U.S. should respond to competitiveness challenges, which the U.S. faced from Japan.

Each ERC is established as a partnership between academia and industry (in some cases with the participation of state, local, and/or other federal government agencies). The ERCs differ from one another in terms of how they are organized, because they originate through a bottom-up process in response to proposal solicitations. Still, all ERCs share several important features:

- Long-term strategic vision for an emerging engineering-oriented area with the potential to spinoff new industries or advance an existing industry's products, processes, service delivery, or infrastructure systems
- Strategic plan outlines how the center will advance knowledge, technology, and education in its targeted area
- Research program that integrates cross-disciplinary fundamental research and the advancement of resulting technologies to test theory in functioning systems
- Educational program development and outreach
- Industry partnerships.

Third generation (Gen-3) ERCs were established in 2008 to promote faster movement of ideas to the commercial sector. The key elements of Gen-3 ERCs are

- Research and educational partnerships with foreign universities
- Collaborative research with small firms

[102] Joseph Bordogna, Engineering Research Centres 2000 Annual Meeting, November 6, 2000

- An emphasis on speedy technological innovation
- Long-range educational collaborations with primary and secondary schools

Each ERC submits annual progress reports. Based on these reports, a center’s performance and plans are reviewed by a panel of outside experts. Continuing support levels are based on the outcomes of the annual reviews and the availability of funds. An ERC may submit a renewal proposal in the third and sixth years. This renewal proposal undergoes merit review by outside experts.

Applications are selected from proposals based on reviews submitted by specialists in the substantive area of the proposal. Reviewers are selected by program officers who oversee the review process. In addition to reviewer recommendation, all NSF proposals are evaluated based on the agency's two standard review criteria: intellectual merit and broader impacts of the proposed activity.

Only U.S. academic institutions with undergraduate and doctoral engineering programs may submit proposals as the lead institution. Third generation ERCs require partnerships with foreign universities concerning research collaboration and educational experiences.

Fixed calls for proposals are solicited by the NSF for the ERC program. There is no restriction on the number of proposals that may be submitted by a lead institution.

Computer and Information Science and Engineering (CISE) Computing Research Infrastructure (CRI) (NSF)

The National Science Foundation's Computing Research Infrastructure (CRI) program within the Directorate for Computer and Information Science and Engineering (CISE) "supports the acquisition, development, enhancement, and operation of research infrastructure that enables discovery, learning, and innovation in all computing fields supported by CISE. Supported infrastructure includes instrumentation needed by for individual research and education projects, major experimental facilities for an entire department or for multi-institutional projects, and test beds or data archives for an entire subfield of CISE researchers.[103]"

The CRI program has two major goals:

1. To provide infrastructure that enables high-quality computing research and education;
2. To extend the set of individuals and departments able to conduct such activities.

The program also targets submissions from minority-serving educational institutions to ensure access to computing-oriented research infrastructure.

The CRI program supports a supports a range of computing infrastructure needs, including:

- General or specialized research equipment, technical support, and / or software;
- Development of data archives or libraries of software tools.

One key goal of the CISE Computing Research Infrastructure (CRI) program is to provide infrastructure that enables high-quality computing research and education. A second goal is to extend the set of individuals and departments that are able to conduct such activities.

There are three types of CRI awards:

- Infrastructure acquisition (awards up to $1,500,000 for three years)
- Acquisition, development, deployment or operations (up to $4 million for four years and up to $250,000 to operate the infrastructure)
- Planning (up to $ 100,000 for proposal preparation)

Awards are reviewed on an annual basis through the submission of annual reports.

Proposals are peer reviewed. The standard NSF review criteria apply: intellectual merit and assessment of broader impacts. In addition, proposals are also reviewed based on:

[103] http://www.nsf.gov/pubs/2004/nsf04588/nsf04588.htm

- Whether the requested infrastructure will enable the proposers and/or a broader community to undertake important work that would not be possible without the infrastructure;
- Whether there is strong synergy present in the proposal that would not be found in individual grants;
- Potential impact on broadening participation of underrepresented groups in the CISE research and education enterprise.

Site visits are made for large proposal reviews.

Institutions based in the EU are not eligible under this program. Proposals may be submitted by U.S. graduate-degree-granting institutions and U.S. four-year institutions that have research and education programs in relevant areas.

The Committee of Visitors report for the CISE division reported that the peer review process led to high quality proposals being selected and that some discretion was used to select high risk proposals.

Innovation Corps Program (I-Corps)

The Innovation Corps Program (I-Corps) is established by the National Science Foundation (NSF) to promote translation of basic research into technologies, products and processes. Currently this program is gaining traction and is being adopted by other federal agencies as well.

This program identifies NSF-funded researchers to whom additional support will further readiness to transition of technology; accelerate innovation that can attract third-part funding.

The priority of the I-Corps program is to assess a particular project in terms of:

1. The viability of products and services coming out the project
2. A transition plan to transform research into products and services
3. A technology demonstration for potential partners.

The program is inspired by the Obama Administration's white paper on *"A strategy for American innovation: Driving towards sustainable growth and quality jobs"* in 2009.

Proposers to this program must have an active NSF award or one that has been active within the previous five years from the date of submission of the I-Corps proposal in a science or engineering field relevant to the proposed innovation.

Application to this program may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the U.S., acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Other Federal Agencies and Federally Funded Research and Development Centers (FFRDCs).

NSF gives awards to I-Corps teams that already exist prior to proposal submission. The I-Corps team consists of three roles:

1. Entrepreneurial Lead, who demonstrates the potential for commercial viability;
2. The I-Corps Mentor, who is typically an experienced or emerging entrepreneur with experience in transferring technology out of academic labs;
3. The Principal Investigator, who is responsible for grant management.

The approach to developing the technology is based on a structured hypothesis/validation approach.

Small business related programs

Small Business Innovation Research (SBIR) program[104]

The Small Business Innovation Research (SBIR) program encourages small business to commercialize technologies. The program seeks to stimulate entrepreneurial start-ups in scientific and technological areas by providing funding for early stage work. Agencies at Federal level with R&D budgets of $100 million or more must reserve a percentage of that funding for this program. Eleven federal agencies currently offer SBIR awards: the Departments of Education (ED), Agriculture (USDA), Commerce (DOC), Defense (DOD), Energy (DOE), Health and Human Services (DHHS), Homeland Security (DHS), and Transportation (DOT); the Environmental Protection Agency (EPA), the National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF). Further, state and local innovation programs often rely on SBIR awards as a proxy for companies to invest in because the due diligence has already been completed by SBIR staff, thus lowering the costs of investment in market ready technologies.

SBIR targets the entrepreneurial sector of small and medium-sized enterprises to stimulate innovation. However, the risk and expense of conducting R&D are often beyond the means of many small businesses. By reserving a percentage of federal R&D funds for small business, SBIR enables these firms to develop their ideas.

The SBIR program was established under the Small Business Innovation Development Act of 1982 (P.L. 97-219), reauthorized until September 30, 2000 by the Small Business Research and Development Enhancement Act (P.L. 102-564), and reauthorized again until September 30, 2008 by the Small Business Reauthorization Act of 2000 (P.L. 106-554). It has been extended again for another period.

The SBIR program is funded by several government agencies, including the Departments of Health and Human Services (DHHS), Agriculture (USDA),Commerce (DOC), Defense (DOD), Education (DoED), Energy (DOE), Homeland Security, and Transportation (DOT); the Environmental Protection Agency (EPA), the National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF).

The key policy priority is to stimulate small technology companies to develop their ideas to enhance U.S. competitiveness and security and there is no specific thematic orientation. This program was inspired by a national policy debate about the ability of small firms to participate in federal R&D.

Funding comes from eleven participating federal departments and agencies. The agencies designate R&D topics through requests for proposals and accept submissions. SBIR awards are based on small business/non-profit research institution qualification, degree of innovation, and future market potential.

Applicants to the SBIR program may receive up to various levels of support that correspond to the degree of development of the idea. Phase I awards provide funding of up to $100,000 for approximately one year to support the exploration of the scientific, technical and commercial feasibility of an idea or technology. Phase II awards provide funding of up to $750,000 for as long as two years to expand Phase I results. It is anticipated that technologies will move into a Phase III for which no program support is provided but which will attract private sector or other funding as a Phase II innovation moves from the laboratory into the marketplace.

With the SBIR re-authorization approval in 2011, the Phase I awards will increase from $100,000 to $150,000. Phase II will increase from $750,000 to $1 million. Up to 25% of the awards made by the National Institutes of Health, the Department of Energy and the National Science Foundation can be invested in companies that are majority-owned by venture capital firms, including hedge funds or other private equity firms. Other agencies can make up to 15 % of their awards in venture firm-controlled companies. Importantly some states have programs to supplement the federal awards thus providing additional funding to small companies to help them through “the valley of death” stages that pose great risks for business failure while companies seek to commercialize.

[104] http://www.sba.gov/sbir

The NSF SBIR Phase II awardees are asked to provide a commercialization report after the conclusion of the award. The NSF SBIR has developed a telephone interview process to gather this information on the 3rd, 5th and 8th anniversary of the end of the award.

Small businesses must meet certain eligibility criteria to participate in the SBIR program. They must be American-owned and independently operated, for-profit. The principal researcher must be employed by the business and the company size must be limited to 500 employees or less.

Third country and EU participants are eligible to the extent that American ownership comprises at least 51% of the company and it is independently operated. The small business must be physically located in the United States. All other criteria applied to participants from the U.S. are also applied to those in EU countries.

There has been debate in Congress about changing the structure of the program but no new legislation has been passed. In 2011, the program was re-authorized for an additional six years until 2017. President Obama signed the National Defense Authorization Act of 2012 into law on December 31, 2011, which enabled the program to continue.

STTR – Small Business Technology Transfer Program

SSTR is a "small business program that expands funding opportunities in the federal innovation research and development arena. Central to the program is the expansion of the public-private sector partnership to include the joint venture opportunities for small business" and non-profit research institutions.

The STTR program was influenced by the SBIR program. The unique feature of STTR is that it requires formal cooperation between small business and universities. The program has no thematic orientation. Research themes are determined by the participating agencies.

The key policy priority of STTR is to improve R&D cooperation and technology transfer. Other important policy priorities are to use small businesses to stimulate technological innovation, to strengthen the role of small businesses in meeting Federal R&D needs, and to increase private sector commercialization of innovations.

There are three phases of the program: two phases are funded by STTR. Funding originally has come from five federal departments and agencies with R&D budgets of $1 billion or more; the U.S. Department of Homeland Security, which was established in 2003, has been added to this list. The federal agencies designate R&D topics, accept proposals, and make STTR awards based on small business/non-profit research institution qualification, degree of innovation, and future market potential.

Phase I awards provide funding for up to $100,000 for approximately one year for feasibility studies of the scientific, technical and commercial viability of an idea or technology. Phase II awards up to $750,000, for as long as two years, to perform R&D work begin to consider commercial potential. Phase III designates that the innovation move from the laboratory into the marketplace. No STTR funds support activities under Phase III; the small business must find funding in the private sector or other non-STTR federal agency funding.

With the SBIR- and STTR-re-authorization in 2011, Phase I funding will increase from $100,000 to $150,000. Phase II will increase from $750,000 to $1 million. Up to 25 % of the awards made by the National Institutes of Health, the Department of Energy and the National Science Foundation can be invested in companies that are majority-owned by venture capital firms, including hedge funds or other private equity firms. Other agencies can make up to 15 % of their awards in venture firm-controlled companies.

The selection criteria for small businesses are: American-owned and independently operated, for-profit, and company size no larger than 500 employees. The selection criteria for non-profit research institutions are: located in the U.S. and one of the following: non-profit college or university, domestic non-profit research organization, federally funded R&D center. There is no size limit for non-profit research institution. The principal investigator may be employed either by the small business or by the non-profit research institution. The program is not open to third countries.

Summarizing to bring technology from ideas to commercialization, both SBIR and STTR utilize a three phase approach illustrated in the figure below

Figure 4: Three phase approach SBIR/STTR approach

In 2012, the United States Government awarded over $2 billion in SBIR and STTR contracts and grants. The statistics are broken down by agency in Table 2.

Table 2: SBIR and STTR Awards Across All Agencies in 2012

	Phase I			Phase II			Phases I and II	
	# Awards	Total Award Amount	Mean Award	# Awards	Total Award Amount	Mean Award	# Awards	Total Award Amount
USG Total	3818	$608,192,751	$159,296	1717	$1,427,090,839	$831,154	5535	$2,035,283,590
DOD	1974	$228,857,182	$115,936	988	$691,184,809	$699,580	2962	$920,041,991
HHS	864	$248,537,867	$287,660	303	$446,930,993	$1,475,020	1167	$695,468,860
DOE	257	$38,261,210	$148,876	110	$111,862,987	$1,016,936	367	$150,124,197
NASA	298	$36,878,346	$123,753	98	$72,836,274	$743,227	396	$109,714,620
NSF	240	$35,860,350	$149,418	136	$65,386,139	$480,780	376	$101,246,489
USDA	63	$6,234,159	$98,955	25	$10,571,668	$422,867	88	$16,805,827
DHS	36	$4,390,268	$124,727	18	$7,835,609	$453,094	54	$12,225,877
ED	24	$2,623,035	$109,293	14	$9,344,508	$667,465	38	$11,967,543
DOT	21	$3,006,480	$143,166	10	$6,141,311	$614,131	31	$9,147,791
DOC	16	$1,465,801	$91,613	9	$3,029,978	$336,664	25	$4,495,780
EPA	25	$1,978,134	$79,125	7	$2,099,581	$299,940	32	$4,077,715

The Small Business Innovation Research (SBIR) & Small Business Technology Transfer (STTR) Program Interagency Policy Committee Report to Congress[105]

Source: SBIR.gov.

Early Stage Innovation Small Business Investment Company ("SBIC") Initiative

The Early Stage Innovation Small Business Investment Company ("SBIC") Initiative is a funding program to enhance small business access to capital. The initiative provides Small Business Administration (SBA) matched funding to early stage venture funds. The objective of the initiative is

[105] The shading of the mean award column indicates award size, with lighter shading indicating smaller mean awards and darker shading indicating larger mean awards. The HHS row (for the Department of Health and Human Services) is dominated by awards issued by NIH. A total of 96% of the awards (amounting to 98% of the total dollars awarded by HHS) are from NIH awards. The rest are from other parts of HHS, including the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA).

to promote American innovation and job creation by encouraging investment in early stage small businesses.

The program is a part of American government's "Start-Up America Initiative". The "Start-Up America Initiative" intends to promote innovation and job creation through a range of initiatives including: expanding access to capital for start-ups, expanding entrepreneurship education, strengthening commercialization of federally-funded research and development, and expanding collaborations between large companies and start-ups. In Small Business Administration's Start America Initiative, the agency sets up two $1 billion funds, Impact Investment Fund and Early-Stage Innovation Fund, targeting companies located in underserved communities and early-stage innovative companies, respectively. It is believed that support for small businesses will help advance economic growth.

The Initiative targets early-stage innovative companies facing difficult challenges accessing capital, especially those without necessary assets or cash flows for traditional bank funding. In particular, the Initiative identifies a gap in funding for high-growth companies in financing rounds between $1-4 million. The initiative seeks to provide match funding to enhance funding flow from venture capital to these firms.

Certain financing organizations are licensed as Small Business Investment Companies (SBICs). The licensing requirements include the qualifications of the fund manager, track record of the fund, and the fund's proposed structure and investment strategy. Fund managers are asked to complete questionnaires which are reviewed by the SBA and an investment committee. Selected funds can then apply to participate. The Initiative provides a 1:1 match to private capital raised by these SBICs.

The Initiative distributes funding on an annual call basis. Applicants to the funding are evaluated on the basis of management qualification, track record, proposed investment strategy, and proposed fund structure and economics.

The funding licensing process includes four steps:

- SBA accepts management assessment questionnaires
- SBA performs initial review and the Investment Committee determine preliminary qualification of applicants.
- Selected applicants submit licensing application.
- SBA will perform due diligence and license qualified applicants.

The Initiative is part of the mission of SBA in supporting small business and is **not** open to third countries. Additionally SBIC may **not** invest in businesses with **more than 49%** of their employees located outside the U.S. or its territories. Thus at least 51% of the employees has to be located in the U.S. Furthermore, the SBIC may not invest in project finance, real estate, farmland, financial intermediaries or passive businesses[106].

The Social Innovation Fund

Social Innovation Fund

The Social Innovation Fund provides funding to low income communities for programs to address economic, health, and children's problems. Grants are awarded through competitive solicitations. Grantees in the Social Innovation Fund must be existing organizations, which must provide a match for the fund and assess the results of their interventions.

There is a national debate about how best to structure policies relating to solving problems in low income communities. There are many existing programs and many organizations in communities but

[106] As of October 2014 there is a final rule on Passive business. This modification allows an SBIC to structure an investment utilising two levels of passive small businesses as pass-through entities under specific circumstances. https://www.federalregister.gov/articles/2014/10/21/2014-24803/small-business-investment-companies-investments-in-passive-businesses

problems still remain. Having a program that brings together these existing programs and organizations is the inspiration for the Social Innovation Fund.

The rationale for this program is that while there are many existing initiatives to help communities they often call for the creation of new organizations rather than assembling existing in-community resources to solve problems. Moreover, they do not apply evidence based approaches and social experiments to determine which approaches are effective. The Social Innovation Fund is designed to address these issues by requiring leadership of existing community-based organizations and the application of evidenced based approaches and social experiments.

The program is implemented through fixed calls for proposals run by the Corporation for National and Community Service. The types of actions funded include programs to enhance economic opportunities, medical health, and children's development. The awards are typically €.8 million ($1 million) a year for up to five years.

The Corporation for National and Community Service is the key organization administering the Social Innovation Fund. This organization was established in 1993 by then President Bill Clinton to encourage Americans to devote a period of time to volunteer service in local communities. The Social Innovation Fund has technical staff that review grant applications to ensure that these applications comply with grant specifications. At least three expert reviewers external to the program provide review comments. These comments are taken on board, along with a review of the budgets, by the technical staff, which may then ask proposers clarifying questions. Technical staff makes the final decision about which applications will be funded.

Semi-annual reports are required of grantees. These reports must include outcomes, how these outcomes are measured, and what indicators are used to show success or failure. Selection criteria are based on three areas: program design, organizational capacity (past grants received, ability to evaluate success, financial oversight capabilities, plans for sustainability), and budget adequacy and cost effectiveness.

A recent report by the National Research Council indicated the necessity of having evidence-based programs and evaluations for social prevention and promotion programs, which is the central tenet of the Social Innovation Fund. See National Research Council and Institute of Medicine (2009). Preventing Mental, Emotional, and Behavioral Disorders among Young People: Progress and Possibilities. Committee on Prevention of Mental Disorders and Substance Abuse among Children, Youth and Young Adults: Research Advances and Promising Interventions.

2.1.3 Business financing system

Since 1946, when the American Research and Development Corporation was established, the United States have been and still are the leaders in the venture capital industry.

At the state and local level there exist many partnerships, programs, and initiatives aiming to help with venture funding, particularly to smaller and earlier stage start-ups. There are a lot of interesting practices with states and localities providing investment for start-ups with innovative combinations and practices, such as the TBED (technology based economic development) Award for excellence in technology based economic development. The *Excellence in TBED Awards* is presented to organizations demonstrating successful local, state and regional efforts across six categories:

- Expanding the research capacity
- Commercializing research
- Building entrepreneurial capacity
- Increasing access to capital
- Improving competitiveness of existing industries

- Most promising TBED initiative[107]

Some have also created angel capital networks and provided angel investment tax credits to help private funders to better coordinate their efforts and find deals. Some indicative examples include of angel investment tax credits are listed below:

- In May, the Governor of Colorado, John Hickenlooper signed the Advanced Industries Investor Tax Credit (HB14-1012) into law. The angel tax credit provides up to $50,000 in state income tax credit for qualified investors who make an investment of $10,000 or more for early stage, qualified Colorado-based companies who fall within specified advanced industries sectors.
- A measure to extend Minnesota's Angel Tax credit two more years and add funds was signed into law by Governor Mark Dayton. The bill increases the yearly allotment from $12 million to $15 million and adds an additional $3 million this year.
- An expansion to the New Mexico Angel Tax Credit (HB 94) proposed by Governor Susan Martinez was postponed indefinitely. The proposal aimed to increase the maximum individual investment cap from the current, $100,000 to $250,000 in investments for up to five companies. This raises the overall credit from $750,000 to $2 million.

Finally, the federal government, through the Small Business Administration's Small Business Investment Company, provides capital subsidies to some private sector venture firms, while the Small Business Innovation Research (SBIR) program provides modest research grants to small firms.

In general, firms in the U.S. have access to a wide array of financing sources, the vast majority of which are provided by the private sector. While the initial public offering (IPO) market is smaller than it has been in the past, many growth-oriented innovation-based firms are able to obtain capital through IPO placements. However, with the IPO market more limited, increasingly the "exit" strategy for small, high-growth start-ups is acquisition by larger, more established technology companies and through licensing.

The Manufacturing Extension Partnership (MEP)

In the U.S., the National Institute of Standards and Technology's Hollings Manufacturing Extension Partnership (MEP) provides support to the small and medium-sized U.S. manufacturers to help them create and retain jobs, increase profits, and save time and money. The nation-wide network provides a variety of services, from innovation strategies to process improvements to green manufacturing. MEP also works with partners both at the state and federal level on programs that put manufacturers in position to develop new customers, expand into new markets and create new products. As a program of the U.S. Department of Commerce, MEP offers a range of effective resources to help manufacturers identify opportunities that will accelerate and strengthen their growth and competitiveness in the global marketplace.

Innovation is at the core of MEP's activities. Manufacturers that accelerate innovation are far more successful than those who don't. By placing innovations developed through research at federal laboratories, educational institutions and corporations directly in the hands of U.S. manufacturers, MEP serves an essential role sustaining and growing America's manufacturing base. The program assists manufacturers to achieve new sales, lead to higher tax receipts and new sustainable jobs in the high paying advanced manufacturing sector.

As a public/private partnership, MEP delivers a high return on investment to taxpayers. For every one dollar of federal investment, the MEP generates nearly $19 in new sales growth and $21 in new client investment. This translates into $2.2 billion in new sales annually. For every $1,978 of federal investment, MEP creates or retains one manufacturing job. America needs a robust manufacturing base and MEP is critical to the small and mid-sized U.S. manufacturers who strengthen that base.

[107] Check out award winners here http://www.sstiawards.org/?page_id=170

Small Business Development Centers (SBDC) program

The Small Business Development Centers (SBDCs) provide assistance to small businesses and aspiring entrepreneurs throughout the United States and its territories. SBDCs help entrepreneurs realize the dream of business ownership and help existing businesses remain competitive in a complex, ever-changing global marketplace. SBDCs are hosted by leading universities and state economic development agencies, and funded in part through a partnership with Small Business Administration (SBA).

SBDC advisors provide aspiring and current small business owners a variety of free business consulting and low-cost training services including: business plan development, manufacturing assistance, financial packaging and lending assistance, exporting and importing support, disaster recovery assistance, procurement and contracting aid, market research help, 8(a) program support, and healthcare guidance.

With several host networks branching out with hundreds of service delivery points throughout the U.S., the District of Columbia, Guam, Puerto Rico, American Samoa and the U.S. Virgin Islands, SBDC assistance is available virtually anywhere.

2.1.4 Innovation funding trends[108]

As stated in the latest mini TrendChart country report for the U.S. "research and technologies and fiscal incentives account for the largest share of innovation budgets. Research and technologies comprise more than one third of the budget across all measures. Still, if the R&D tax credit is to be exempted, the research budget accounts for two-thirds of total expenditures. These estimates concern promoting and sustaining the creation and growth of innovative enterprises. Governance of research and innovation policies account for most of the remaining share (12% of the total and 23% if the R&D tax credit is excluded). Human resources development is only 3% of the total budget and 6% of the non-R&D tax credit budget".

According to the same report, these budgets were at lower levels in 2010 than the respective ones for 2009 with the exception of research and technology budgets. In 2009 and 2010, there was an increase in incentivized investments in order to help deal with the crisis.

The main sources of funding remain the same and concern mainly federal grants. In addition, state governments have also had to face the economic downturn and have consequently made significant reductions to research and innovation investments, which are more severe than those in the federal budget.

On the other hand there have been a number of significant efforts in providing state funding to support innovation. For example, the State of Ohio, through its Third Frontier program approved $2.1 billion to support innovation, by popular vote in 2002 and extended for 5 years in 2010 by the state's tax payers.

National funding represents the largest share in these measures. Leveraged funding with the private sector, universities, or non-profit organizations is not reflected in these budget figures. The extent of cost share varies widely between programs. Several of the programs that promote public-private partnerships – such as the Technology Innovation Program – have experienced downward budgetary trends. In terms of thematic or sectorial focus, energy research is of high priority in the current administration.

[108] INNO Policy TrendChart: Mini Country Report/United States of America: http://ec.europa.eu/enterprise/policies/innovation/files/countryreports/usa_en.pdf

2.1.5 Procurement policy[109]

According to the 2012 ERAWATCH country report for the U.S., the "U.S. does not have a centrally coordinated innovation procurement policy within the federal government. The Office of Management and Budget runs the Office of Federal Procurement Policy, which helps operate federal policies spending by federal agencies yearly on mission-related materials, supplies and services. Several associated harmonizing organizations (e.g. The Chief Acquisition Officers Council (CAOC), Federal Acquisition Institute and the Defense Acquisitions University) provide help, mainly with information sharing and training sessions for those working in the public procurement area. The Defense Department manages the Office for Acquisition, Technology and Logistics. The purpose of this office is to assess defense-related technologies.

The contracting out of government functions (including R&D functions) has been part of a trend toward privatizing public sector services. The scope behind this privatizing is to promote private sector efficiencies. There has been an increase in R&D and management and operations (M&O) contractors for the national laboratories, termed government owned contractor operated (GOCO).

Although the U.S. does not have an official policy to use public procurement for promoting private R&D, there are a few programs that use public procurement in this way. The SBIR program uses pre-commercial procurement, being one of the most prominent demand-side programs in the U.S.. This program involves 11 agencies with extramural research budgets of more than € 71.1 million ($100 million), with the Department of Defense accounting for half of SBIR procurements, followed by the Department of Health and Human Services, National Aeronautics and Space Administration (NASA), Department of Energy, and National Science Foundation. A considerable number of companies participate in the program as evidenced by the more than 4000 average annual number of SBIR Phase I awards made from 2002 to 2010 and more than 1800 average annual number of SBIR Phase II awards made during this same time period.

This is also the case with defense procurements; defense procurement of transistors and aircraft has been important in stimulating the semiconductor and aerospace industries. In addition, the Defense Advanced Research Projects Agency (DARPA) support for an early packet-switched network has been considered a precursor to the Internet (OECD 2011). For the most part, however, public procurement is not aimed at this effect. Here is worth mentioning also the Broad Agency Announcements, which is a technique for United States government agencies to contract for basic and applied research and certain development. The technique may be used to acquire "scientific study and experimentation directed toward advancing the state-of-the-art or increasing knowledge or understanding." Whereas the announcement published in Federal Business Opportunities, describes "broadly defined areas of interest".

Here it is worth mentioning that in regards to military public procurement and in the frame of the Policy Workshop report of the workshop 'Innovating out of the Crisis' organized by the High Level Economic Policy Expert Group Innovation for Growth i4g in Brussels 2012[110], David Mowery[111] proposed that US military procurement has influenced adoption in the civilian economy as much as innovation. US military procurement has had positive and negative effects in 'dualuse' technologies. Military influence in IT has declined over time and 'spin-off' revenues also benefited from the scale of US military procurement programs, which enabled competition among suppliers. However, procurement has enjoyed less success in US energy policy.

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[109] http://erawatch.jrc.ec.europa.eu/erawatch/opencms/search/advance-search.html?tab=reports&country=us#listado

[110] https://ec.europa.eu/research/innovation-union/pdf/expert-groups/i4g_report_-_workshop_november_2012.pdf

[111] David C. Mowery is the Milton W. Terrill Professor of Business at the Walter A. Haas School of Business, University of California at Berkeley. He is Director, PhD Program, Haas School of Business, U.C. Berkeley and Deputy Director, Institute for Management, Innovation, and Organization as well as Research Associate, National Bureau of Economic Research.

2.1.6 Assessing innovation policy effectiveness[112]

There are not too many recent evaluation activities taking place at the federal level. Actually, the most recent one concerns the assessment of innovation policy in the U.S. and is entitled “Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5”; this report was released in 2010. According to the statistical evidence presented in this report, it appears that the U.S. research and innovation position has declined relatively to other countries. The report emphasizes that in many cases, other countries both in Europe and in Asia have taken up the recommendations that were provided by the earlier assessment report to a greater extent than the U.S. itself has.

The key points highlighted in this report concern “having qualified teachers in primary and secondary school, doubling research budgets in the physical sciences and maintaining biological science budgets. In addition, the report highlighted weaknesses in H1-B visa granting[113], intellectual property laws, export control policies and the lack of permanence of the R&D tax credit”.

The report came in at a time when the world and the U.S. are dealing with a fiscal crisis that militates against considerable new spending initiatives; as a consequence, the ability to innovate is negatively affected to the extent that it leads to financial uncertainty, rising interest rates, and decreased private sector investment.[114]

On the other hand, the policy actions at state level are not officially reported/ evaluated and thus making it hard to conclude to an educated assessment of the effectiveness of these actions, although we are aware that there is activity towards this direction.

Around the same time in 2010, the NSF published statistics about business innovation in the U.S., which caused some discussions[115]. Preliminary data from the NSF 2008 Business R&D and Innovation Survey (BRDIS) provided a map of the incidence of innovation by businesses located in the U.S. These data were based on respondents to the survey and represented an estimated 1.5 million for-profit companies, publicly or privately held, with 5 or more employees, active in the U.S. in 2008. These data indicated that in the period 2006–08 about 22% of the manufacturing companies introduced product innovations and also about 22% introduced process innovations. Whereas in the same time, about 8% of companies in the nonmanufacturing sector were product innovators and 8% were process innovators. Further, the BRDIS data indicate that companies that perform and/or fund R&D have a far higher incidence of innovation than do companies without any R&D activity. As these statistics reveal the U.S. innovation varies substantially by industry sector.

2.1.7 Internationalization of innovation policies[116]

There are several and strong connections between Europe and the U.S. with regards to science and technology that relate also to innovation policy. There are a number of umbrella Science and Technology Agreements that have been set up between the U.S. and 37 countries of which Europe and European countries figure prominently (including Bulgaria, Croatia, Finland, France, Greece, Italy,

[112] INNO Policy TrendChart: Mini Country Report/United States of America: http://ec.europa.eu/enterprise/policies/innovation/files/countryreports/usa_en.pdf

[113] The H-1B is a non-immigrant visa in the United States under the Immigration and Nationality Act, section 101(a)(15)(H). It allows U.S. employers to temporarily employ foreign workers in specialty occupations. If a foreign worker in H-1B status quits or is dismissed from the sponsoring employer, the worker must either apply for and be granted a change of status to another non-immigrant status, find another employer (subject to application for adjustment of status and/or change of visa), or leave the U.S. (source: Wikipedia - http://en.wikipedia.org/wiki/H-1B_visa)

[114] Scott Andes. (2010). Give Innovation a Chance. Washington DC: Progressive Policy Institute. progressivefix.com.

[115] http://www.nsf.gov/statistics/infbrief/nsf11300/

[116] INNO Policy TrendChart: Mini Country Report/United States of America: http://ec.europa.eu/enterprise/policies/innovation/files/countryreports/usa_en.pdf

Romania, Slovakia, Slovenia, Spain, and others). There is also an agreement at the EU level[117, 118]. Innovation issues specifically concerning intellectual property protection are common in these agreements, with an annex outlining intellectual property rights accompanying each agreement.

At the level of individual U.S. policy measures, more than a few measures allow for third country participation. Nearly one-quarter of the measures provide funds to other countries as long as the leading organization is a U.S.-based university or other research institution. About 40% of the measures do not provide funding to non-U.S. institutions. The remaining 40% have some pre-requisites for allowing receipt of U.S. funds by third countries. These pre-requisites vary widely and include permanent residency in the U.S., lack of availability of talent in the U.S., majority ownership by a U.S.-based entity, U.S. run business with a foreign parent company, and limitation on the use of funds.

Joint-ventures and corporate internationalization are common features of the U.S. private sector. There are no particular policies to explicitly encourage these types of international connections. Some U.S. funding programs allow participation of foreign firms. For example, the SBIR program does not allow foreign-based firms to have direct eligibility, but there can be up to 49 per cent participation by foreign business entities in a joint venture.

2.1.8 Future Challenges for Innovation Policy[119]

Some of the key challenges that need to be addressed by the U.S. on innovation policy concern the following:

- **Innovative start-ups financing**: the VC industry has grown enormously in the United States in the last two decades. During the recession, the focus of venture capitalists has been on upstream and in larger deals, leading some to argue that there is a capital gap in earlier stage, smaller deals. In addition, while most venture capital placements are concentrated in a few states (e.g., California and Massachusetts, and to a lesser extent Colorado and Washington), there is some venture funding in almost every state. There is also a robust "angel capital" system in the United States made up of private individuals of high net worth who invest money into entrepreneurial, high-growth companies. [120]This is a key problem, leading to the question, how will innovative start-ups get funded?
- **Bridging the innovation performance gap:** There is an innovation gap in the U.S. among those performing well and those who are underperforming, leading to two different Americas. A key challenge to be addressed is how policies should be formulated in order to help those states, regions, cities or even people who underperform to catch up; also, how can policies help rural areas to benefit from and/ or manage less growth smaller populations.
- **"Production" of Innovators and innovation workers:** The introduction of innovators and innovation workers in the market has been less than ideal latterly. On many metrics, including grade-level proficiency and college graduation rates, America has slipped behind other countries[121]. The increasing costs of higher education and STEM education through colleges and universities are pricing people out of relevant education thus creating a gap in the innovation market.
- **Transformation of institutions concerning financial accessibility to higher education:** STEM education and related higher education is becoming increasingly expensive in the U.S..

[117] Helena Acheson and Gonzalo León: Evaluation of the EU-U.S. Agreement on S&T. Final Report. March 2013
[118] http://www.state.gov/documents/organization/229961.pdf
[119] Ibid.
[120] Robert D. Atkinson, "Understanding the U.S. National Innovation System", The Information Technology & Innovation Foundation (ITIF), June 2014. http://www2.itif.org/2014-understanding-us-innovation-system.pdf
[121] A Strategy for American Innovation". White House, 2011,

Student loans are currently out of control and this leads into a society where the costs of advanced education are far too high for the average American family. It is considered necessary that there is action to this end, in order to improve financial accessibility for all that wish to receive this type of education.

- **Improve Industry – Academia relationships/ collaboration**: It is very important that the universities start having a more "entrepreneurship-friendly" character, fostering collaborations with industrial R&D departments that will allow exploitation of joint research interests and will enhance the role of academia in the commercialization of innovation process.

Other, less critical challenges concern governance and coordination across administering federal agencies. The administration of the Small Business Innovation Research (SBIR) program is an illustrative example. The Small Business Administration (SBA) is responsible for overseeing the SBIR program. The SBA sets guidelines for how awards are set what the standard award sizes should be. However, the agency allows flexibility in how each of the 12 participating agencies follows these guidelines. As a result, procedures vary widely, with the Department of Defense, NASA, and Department of Energy using in-house technical experts and the NIH and NSF using external reviewers.

Another challenge to be faced includes innovation funding at the federal level. Given the global economic downturn and at the same time the growth in the federal budget deficit, less funding has been made available for investment in innovation policy. Research programs continue to attract the greatest support for federal investment. Areas, which appear to involve federal government direction of private commercialization – innovation programs to promote human capital development, creation and growth of innovative enterprises, and markets and innovation culture – are receiving less federal funding.

State governments typically take a more indisputable role in innovation policy not only because of their greater proximity to local industry sectors but also because they design and implement policy measures to foster and support innovation at state level. However, state budgets have also been cut, which has resulted in substantial cuts to innovation programs. A study conducted by the Rockefeller Institute in 2010, indicates that state revenue levels at the end of 2010 were below the respective levels of 2007. On the other hand, state tax revenues were moving upward (42 out of the 50 states have had a positive revenue of about 8% in the fourth quarter of 2010). This is a promising evolution, as the state revenues could enable future investment in innovation policy.

3 S&T Cooperation between EU & the U.S.

Background & History

Back in 1953, the international collaboration between EU and the U.S. was established; almost four decades after that, the Transatlantic Declaration in November 1990 formalized the cooperation patterns. The New Transatlantic Agenda (NTA) was agreed upon in December 1995 and along with the Transatlantic Economic Partnership (TEP) which was launched in 1998 and the Transatlantic Economic Council (TEC) that was created in 2007 they focus on the efforts to further enhance transatlantic cooperation and economy.

The main objective of the collaboration agreements is to allow the EU and the U.S. to focus on their own targets and address their own needs, but at the same time to find common ground and interests to jointly pursue.

Europe has traditionally been an important science and technology partner for the U.S. and there is a long productive record of research linkages between the two sides.

Researcher exchanges [122] between the U.S. and Europe has always been a key cooperative research activity. The EU's Marie Curie researchers' exchange program is one of the most favorable ones in the U.S. and proves that exchanges still dominate the S&T relationship between the EU and the U.S..

EU-U.S. collaboration patterns of today

As indicated by Helena Acheson and Gonzalo Leon, in their report "Evaluation of the EU-U.S. Agreements on S&T (March 2013), "the U.S. S&T system, is far too complex, comprising of several quasi-independent agencies for funding R&D activities (some of which are mission-oriented); there is a growing role of some States where the innovation policy is confined but there is also growing attention to the research activities at the international level. This has made it much more difficult for the EU to have a single path for implementing specific joint actions".

In the area of science and technology, the EU and U.S. concluded a Science and Technology (S&T) Co-operation Agreement in 1999[123] which was renewed in 2004[124] , 2009[125], and 2014[126]. Since then, joint research activities are undertaken in a number of fields such as biotechnology, environment, materials science (including nanotechnology) and non-nuclear and renewable energy.

S&T co-operation between Europe and the U.S. is based on a variety of instruments using a combination of unilateral, bilateral and multi-lateral approaches. The U.S. tends to use Europe's position for benchmarking activities in science and technology. Cooperation through short-term research projects often provides the starting point for longer-term collaboration relationships but a complementary approach is possible e.g. through the SAVI (Science Across Virtual Institutes) [127]mechanism recently created by the NSF (NSF, 2011).

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[122] One of the earliest exchanges is the Fulbright Program which was created after World War II in the Fulbright Act of 1946 (Public Law 584) to support international exchanges between Europe and the U.S..

[123] http://archive.eussciencetechnology.eu/uploads/docs/28508e3ca2f71499713db5b3c558255ec6107b91.pdf

[124] http://archive.eussciencetechnology.eu/uploads/docs/EU_USagreementS&T_renewal.pdf

[125] http://archive.eussciencetechnology.eu/uploads/docs/extension_2009.PDF

[126] http://www.state.gov/documents/organization/229961.pdf

[127] **Science Across Virtual Institutes (SAVI)** as expressed in its Webpage "*is a mechanism to foster and strengthen interaction among scientists, engineers and educators around the globe. It is based on the knowledge that excellence in STEM (science, technology, engineering and mathematics) research and education exists in many parts of the world, and that scientific advances can be accelerated by scientists and engineers working together across international borders. SAVI is not a stand-alone program. Proposals to support SAVI activities can be submitted as a supplemental funding request to an existing award, or as a full proposal to an existing, active NSF program that best fits the proposed subject matter*".

SAVI provides a mechanism for U.S. research communities to build long-term, structured collaborations with partnering countries in STEM fields[128]. These partnerships impacting on research and education should fuel economic growth, prosperity and well-being. With funding also made available from partnering countries, SAVI is expected to provide a virtual yet structured framework to stimulate interaction and collaboration in emerging, new multidisciplinary research and education areas.

Table 3: Other related EU-U.S. Bilateral Agreements in the field of S&T

Agreement between the European Atomic Energy Community (Euratom) and the Government of the United States of America (1958)
Agreement for cooperation between the European Atomic Energy Community and the United States Department of Energy in the field of controlled thermonuclear fusion(1986)
Agreement for cooperation in the peaceful uses of nuclear energy between the European Atomic Energy Community and the United States of America - Agreed Minute - Declaration on non-proliferation policy (1995)
Exchanges of Letters recording the common understanding on the principles of international cooperation on research and development activities in the domain of intelligent manufacturing systems...(1997)
Agreement between the European Community and the United States of America renewing a program of cooperation in higher education and vocational education and training (2000)
Agreement for cooperation between the European Atomic Energy Community represented by the Commission of the European Communities and the Department of Energy of the United States of America in the field of fusion energy research and development (2001)
Agreement renewing the Agreement for scientific and technological cooperation between European Community and the Government of the United States of America (2004)
Agreement between the European Community and the United States of America renewing a program of cooperation in higher education and vocational education and training (2006)

Member States - U.S. Agreements

Today, many Member States have strong cooperation programs with the U.S. supported by specific bilateral agreements at the governmental level or through funding agencies. The Link2US project (Link2US, 2010)[129] indicates that 17 EU Member States and Associated Countries have individual S&T Agreements with the United States. Practically all the signed Agreements cited S&T priority areas. Agriculture, basic research, energy, health, and the environment (including climate change) are the most common areas of cooperation.

Based on the outcomes of the survey conducted in the frame of the Link2US project[130], and on the 2012 ERAWATCH country report for the U.S[131].,there were 18 S&T Agreements, between the U.S. and the following MS:

Table 4: S&T Agreements, between the U.S., Member States and Associated Countries

Bulgaria	Hungary
Croatia	Italy

[128] Science, Technology, Engineering, Mathematics

[129] http://archive.eusssciencetechnology.eu/uploads/docs/LU_D1.2_STAgreement_Correction_final_annexes.pdf

[130] http://archive.euussciencetechnology.eu/link2us

[131] http://erawatch.jrc.ec.europa.eu/erawatch/export/sites/default/galleries/generic_files/file_0417.pdf

Czech Republic	Poland
Denmark	Romania
Finland	Slovakia
France	Slovenia
FYROM	Spain
Germany	Sweden
Greece	Switzerland

The S&T cooperation agreements have a number of common elements. The most substantive of them include:

- **Areas of cooperation:** the most commonly indicated areas reflect both EU and U.S. priorities in key areas of cooperation. The areas of cooperation covered include: the environment, biomedicine and health, agriculture, engineering research, non-nuclear energy, natural resources, material sciences and metrology, information and communication technologies, telematics, biotechnology, marine sciences and technology, social sciences research, transport, science and technology policy, management, training and mobility of scientists. Cooperation activities may take the form of joint task forces, joint studies, joint organisation of seminars and conferences, exchanges of equipment and materials, visits of scientists, engineers or other appropriate personnel, exchange of scientific and technical information.
- **Forms of cooperative activities:** the six basic forms include Coordinated Research projects; joint task forces; joint studies; joint organization of science workshops, conferences, seminars, symposia; visits and exchanges of S&T information and documentation as well as scientists, specialists, and/ or researchers; exchange or sharing of equipment or materials.
- **Coordination of the agreement:** usually coordination takes place through a Joint Consultative Group or a Joint Committee, with representatives of both signatory governments. The Committee or the Group meets annually or at some other interval to review progress on cooperation and discuss areas of cooperation.
- **Entry of personnel and equipment:** Generally, a government is expected to take all reasonable steps, within the appropriate laws and regulations of the respective government, to assist in facilitating the entry and exit of persons, data, material, and equipment related to activities under the S&T agreement.
- **IPR Annex:** Common to all S&T agreements with the U.S., is an annex on Intellectual Property Rights (IPR). Two main topics are being addressed concerning**,** 1) the allocation of Rights and 2) Business Confidential information.
- **Security obligations:** these relate to sensitive information or equipment (protecting information regarding the interests of national defense, foreign relations, or clas sified information, of either Party, in line with applicable national regulations and laws) and unclassified export-controlled information or equipment transferred under the agreement (the transfer of export-controlled equipment and information between the two countries must comply with relevant national regulations and laws to prevent the unauthorized transfer or retransfer of information).

As indicated in the EU-U.S. S&T Cooperation Agreements' evaluation report by Helena Acheson and Gonzalo Leon, "*at the EU level, there is a fragmented overview of the cooperation of EU Member States with the U.S. The signing of those bilateral agreements is negotiated independently and the coordination amongst EU MS after signature is also very weak*".

4 Brief Comparative analysis between the EU and the U.S. based on findings presented

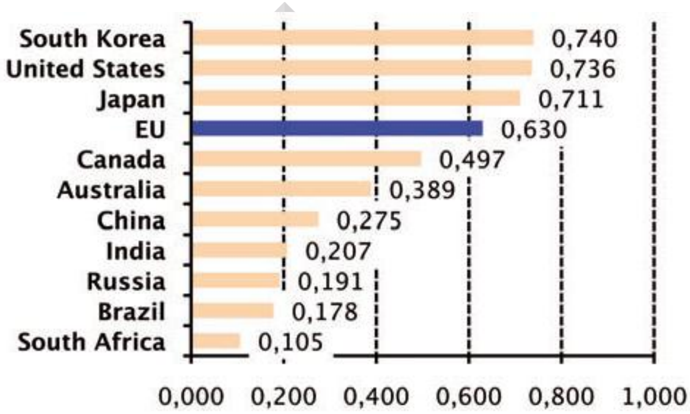
4.1 Innovation Performance[132]

In the latest Innovation Union Scoreboard 2014 report, we can observe that Europe is closing its innovation gap but the main EU innovation competitors, i.e. South Korea, the U.S. and Japan, have a performance lead over the EU. The performance lead has been increasing for South Korea as its growth over 2006-2013 has been more than double that of the EU. Innovation performance for the EU has been improving at a higher rate than that for the U.S. and Japan. As a consequence, the EU has been able to **close almost half of its performance gap** with the U.S. and Japan since 2008.

These three global top innovators are particularly dominating the EU in indicators capturing business activity as measured by R&D expenditures in the business sector, Public-private co-publications and Patent Cooperation Treaty (PCT) patents but also in educational attainment as measured by the share of population having completed tertiary education.

This means that enterprises in these countries tend to invest more in research and innovation and also that collaborative knowledge-creation between public and private sectors is better developed. Further, the skilled workforce in these countries is relatively larger than in the EU. In the same time the EU continues to have an innovation performance lead over Australia, Canada and all BRICS countries (Brazil, Russia, India, China and South Africa).

Figure 5: Global Innovation Performance

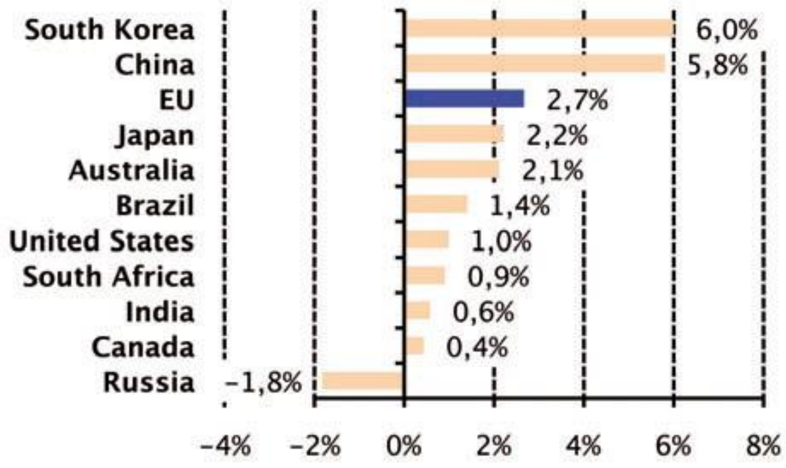


Note: Average performance is measured using a composite indicator building on data for 12 indicators ranging from a lowest possible performance of 0 to a maximum possible performance of 1. Average performance reflects performance in 2010/2011 due to a lag in data availability.

Source: Innovation Union Scoreboard 2014, pg.29

132 Innovation Union Scoreboard 2014

Figure 6: Global Innovation Growth rates



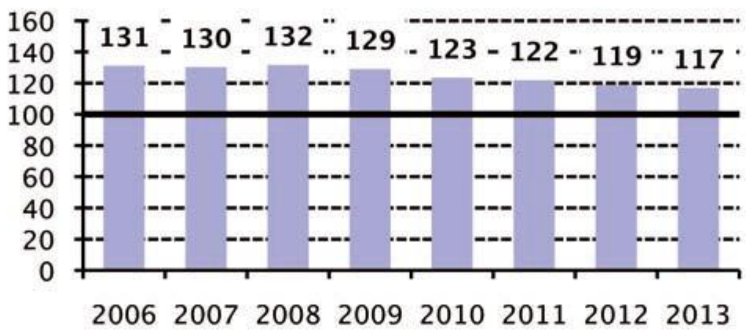
Note: Average annual growth rates of the innovation index have been calculated over an eight-year period (2006-2013). Due to a smaller set of indicators used as compared to the benchmarking for the Member States and the EU the growth rate for the EU in this figure is not comparable to the one discussed before.

Source: Innovation Union Scoreboard 2014, pg.29

4.1.1 Innovation performance indicators: USA vs. EU[133]

For a long time, the United States have been more innovative than the EU; however, notably, their performance lead is continuously decreasing. Between 2006 and 2009 the U.S. innovation index was about 30% higher than that of the EU, but since 2009 the U.S. lead has been progressively declining to 17% in 2013. Between 2008 - when the lead was at its peak - and 2013 the U.S. performance lead has been reduced by almost half from 32% to 17%.

Figure 7: Innovation Performance: USA



The performance scores are calculated by dividing the U.S. innovation index by that of the EU and multiplying by 100. The bold line shows average EU performance at 100 (EU=100).

Source: Innovation Union Scoreboard 2014, pg.33

A closer look at the individual indicators (Table 4) reveals that the U.S. is performing better on **9 indicators**.

[133] Ibid.

Table 5: Current Performance – Key Innovation Indicators in EU and U.S.[134]

Indicator	EU 27 [135]	USA[136]
New doctorate graduates	1,7	1,7
Population completed tertiary education	28,5	**42,4**
International scientific co-publications	343.2	**447.6**
Scientific publications among top 10% most cited	11.0	**14.5**
R&D expenditure in the public sector	0.74	0.73
R&D expenditure in the business sector	1.29	**1.82**
Public-private co-publications	35.6	**69.07**
PCT patent applications	3.75	3.03
PCT patent applications in societal challenges	0.82	0.83
Contribution MHT product exports to trade balance	11.90	1.02
Knowledge-intensive services exports	45.3	45.64
License and patent revenues from abroad	0.59	**0.69**

A much higher share of the U.S. population has completed tertiary education, 42% in the U.S. compared to 28.5% in the EU in absolute terms creating a performance lead of the U.S. over the EU of almost 50%. The number of International co-publications and the quality of U.S. scientific publications are also much higher and the scientific collaboration between the private and public sector is almost double that in the EU. U.S. businesses' expenditure on R&D is about 40% more than the EU respective expenditure (1.82% of GDP in 2011 compared to 1.29% in the EU). The U.S. is also more successful in commercializing new technologies with 17% more License and patent revenues compared to the EU. The U.S. has relative weaknesses in PCT patent application and the contribution of medium-high-tech product exports to the trade balance.

For most indicators however, as seen in Table 2, the relative growth performance of the U.S. has worsened. Only for Doctorate graduates and Knowledge-intensive services exports the U.S. has managed to improve its performance lead. For all other indicators the performance lead has declined.

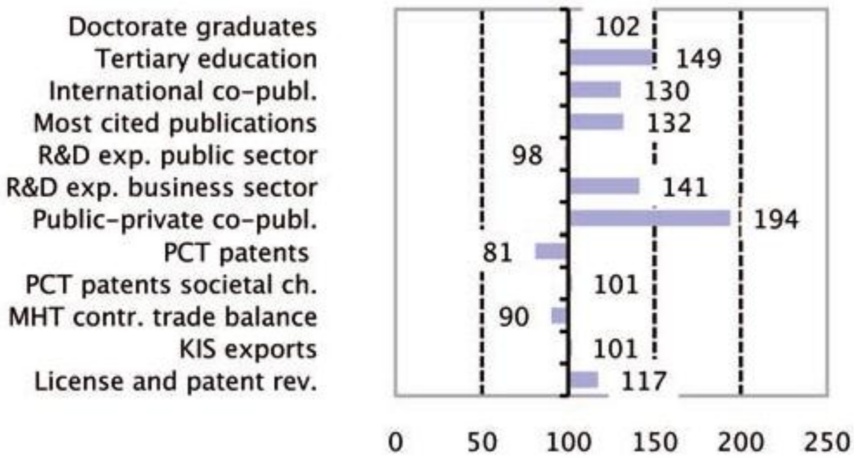
The strongest relative declines are observed for license and patent revenues from abroad, patent applications in societal challenges and International scientific co-publications. In particular for those indicators where the gap is increasing – R&D expenditures in the public sector, PCT patent applications and the Contribution of medium-high-tech product exports to the trade balance – the U.S., compared to the EU, is not performing so well.

[134] Innovation Union Scoreboard 2014: The Innovation Union Scoreboard (IUS) 2014 uses the most recent available data from Eurostat and other internationally recognised sources with data referring to 2012 for 11 indicators, 2011 for 4 indicators, 2010 for 9 indicators and 2009 for 1 indicator. This is why the average for the EU only covers 27 of the 28 Member States.

[135] Innovation Union Scoreboard 2014, Annex A:Current performance, pg.82

[136] Innovation Union Scoreboard 2014, Annex A:Current performance, pg.82

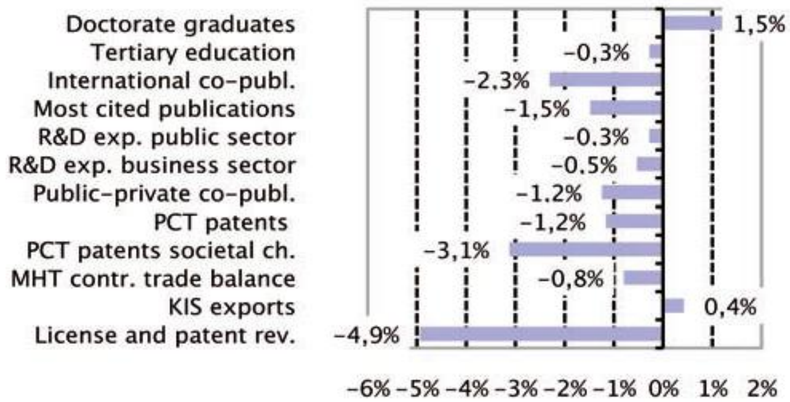
Figure 8: Performance Lead: United States



The scores are calculated by dividing the U.S. indicator value by that of the EU and multiplying by 100.

Source: Innovation Union Scoreboard 2014, pg.33

Figure 9: Change in Performance Lead: United States



The scores are calculated by subtracting the EU growth rate from that of the U.S.

Source: Innovation Union Scoreboard 2014, pg.33

The following subsections briefly summarizes the similarities and differences among the two innovation policy systems, in an effort to provide some useful insight and policy suggestions for further improving collaboration among the EU and the U.S.

4.1.2 Innovation Policy system: USA vs. EU

Both in EU and the U.S. there is no central innovation policy system or a single management authority responsible for the overall design and implementation of innovation policies. On the contrary, policies are being designed at various levels and implementation depends on specific actions, programs and measures in the Member States for the EU and in each State in the case of U.S.

As much in the EU as in the U.S., the focus on innovation started to grow in the early 2000s; for Europe, it was through the Lisbon Strategy, which set European competitiveness as key priority. For the U.S., "the state of industrial innovation and competiveness has gained renewed attention after the losses of the 2000s, the Great Recession and the emergence of robust new technological competitors, including, but not limited to China”[137].

A key difference is that in the U.S. the focus on innovation is placed at the State level, as it is the state governments which are more familiar and close to the needs of the business sectors which comprise the regional economies[138].“There is no national, coordinated innovation policy system in the United States. While, some nations have developed national innovation strategies (e.g., Germany, Sweden, and Finland), the United States generally has not. This reflects in part a belief that innovation is best left to the market and that the role of government, to the extent there is one, is to support “factor inputs” such as knowledge creation and education“[139].Examples for cutting-edge practices being designed, implemented, and evaluated at the state level can be found in Ohio’s Third Frontier Program; in New York’s NYSTAR program, in Maryland’s TEDCO, and Pennsylvania’s Ben Franklin programs. All these programs support funding, accelerating R&D; proof of concept; access to innovation networks etc. It is also critical to stress that in the U.S. the private sector, i.e. the industry undertakes the heavy burden of innovation performance (unlike the situation in most European countries where innovation performance very much relies on Universities and PROs). Although it must be noted here that in Germany more than half of the total R&D expenditures are spent in the business sector. A very important aspect of the U.S. innovation market is that the venture and risk capital organizations are the ones performing assessments and making the funding decisions, being the most important sources of financing of start-ups. Whereas the U.S. system focuses on market-driven innovation, the Europeans direct the innovation system towards certain goals. This is an element that should be discussed as part of a future S&T cooperation so that the implications of the difference in the approach towards innovation are understood since this might have implications also on the form of cooperation agreements. U.S. universities serve not only as sources of innovative ideas, but they also assist and administer the innovation processes by undertaking technology transfer, incubation and spin-off activities while at the same time they also support innovation policy formulation. Likewise in Europe universities in some countries e.g. in Germany have in the last years developed spin-off centers and also set up patent commercialization agencies and moreover many European universities have Technology Transfer offices. However the efficiency and the progress regarding research commercialization is not the same in all Member States and thus comparison is difficult.

Innovation support measures and funding initiatives

In the EU, there is a large number of research and innovation funding mechanisms currently in place focusing on a range of areas. For the programming period of 2007-2013, the major programs were the Seventh Framework Program, the Competitiveness and Innovation Framework Program (CIP), the Structural Funds, and the European Institute of Innovation and Technology (EIT). Since 2013, Horizon 2020 is the new framework program including also the EIT and parts of the CIP, open to the world, aiming to allow participants to focus on what is really important, by minimizing administrative burden. Following Horizon 2020, further measures will be implemented to complete and further develop the European Research Area (ERA)[140]. These measures provide support in the form of **grants**, either fully or co-funding projects and actions, and aim at breaking down barriers to create a genuine single market for knowledge, research and innovation. ERA is focused on maximizing the potential of Europe's open research systems and fostering innovation. By concentrating on research sectors, Europe can provide the framework for regions to specialize in their areas of expertise. Achieving a fully functioning ERA must be a key goal of future research and innovation policy initiatives. This

[137] Robert D. Atkinson, “Understanding the U.S. National Innovation System, June 2014 (The Information Technology and Innovation Foundation)

[138] INNO Policy TrendChart: Mini Country Report/United States of America: http://ec.europa.eu/enterprise/policies/innovation/files/countryreports/usa_en.pdf

[139] Rob Atkinson, “Understanding the U.S. National Innovation System”, The Information Technology & Innovation Foundation (ITIF), http://www2.itif.org/2014-understanding-us-innovation-system.pdf

[140] European Commission: A Reinforced European Research Area Partnership for Excellence and Growth. COM (2012) 392 final. Brussels, 27.07.2012

should acknowledge the need for science to deliver sustainable solutions to societal challenges, the growing demand for research integrity and accountability, and the drive towards a new mode of conducting and sharing research, i.e. Science 2.0.[141]

According to the ERA Progress Report 2014 open and attractive research systems create more innovation. In the same time, institutions that have implemented the ERA guidelines have produced a higher number of publications and patents per researcher. An additional remark in the report is that the efficiency of ERA is higher in those member states which already have nationally implemented measures contributing to the completion of ERA and for which support from research organizations and funding had been made available. Finally, the report points out that smaller research institutions have greater difficulties adapting to the demands imposed by the ERA priorities than bigger ones. At the same time, it is acknowledged that the development of ERA is a gradual process which, at this stage, relies mostly on further action by the member states.

In the U.S., innovation measures address a range of policies (i.e. strategic policies aiming to involve society-driven innovation, strategic research policies, or policy advisory services or strategies) but also research infrastructures, R&D cooperation and grants. Quite a few measures address human capital issues such as science education, relationship between teaching and research, stimulation of doctoral degree holders and incentives for recruiting researchers. There are only a few measures providing fiscal incentives and risk capital while there is only one measure directly dealing with the use of innovative standards. Here as well, nine out of ten measures are grant programs. The rest of the measures focus on non-direct funding through tax credits or implementation of standards.

Support to SMEs & start-ups

In terms of services and support provided towards small enterprises and start-ups Europe, the Enterprise Europe Network (EEN)[142] plays a key role, mainly by helping them into taking up business opportunities in the EU. The network is established in a way that allows support at national and local level, by utilizing the respective member organizations. The network covers a number of key sectors and the services offered span from internationalization and technology transfer to access to finance and research funding. The network also provides consultancy and support with regards to EU law and standards as well as IPR issues and patenting. The network also includes 25 non-EU partners including a branch in the U.S.

Since 1946 when the American Research and Development Corporation was established, the U.S. have become and still are the leaders in the venture capital industry. There are numerous private venture capital firms which assess and fund investment opportunities, but their role is more than this; they participate in key management functions such as serving on boards and advising on business strategy. Although most venture capital placements are concentrated in a few states (e.g., California and Massachusetts), there is at least some venture funding in almost every single state. There is also an “angel capital” system made up of private individuals of high net worth who invest money into entrepreneurial, high-growth companies. In some states, governments have also established programs to help with venture funding, particularly to smaller and earlier stage start-ups. Some have also created angel capital networks to help private funders better coordinate their efforts and find deals.

In the course of measures towards bringing manufacturing back to the U.S., the National Institute of Standards and Technology’s Hollings Manufacturing Extension Partnership (MEP) provides support to the small and medium-sized U.S. manufacturers to help them create and retain jobs, increase profits, and save time and money.

As a program of the U.S. Department of Commerce, MEP offers a range of effective resources to help manufacturers identify opportunities that will accelerate and strengthen their growth and competitiveness in the global marketplace.

[141] European Commission: European Research Area. Progress Report 2014. COM (2014) 575 final. Brussels, 15.9.2014

[142] http://een.ec.europa.eu/

The Small Business Development Centers (SBDC) program supports small businesses and aspiring entrepreneurs throughout the United States and its territories. SBDCs help entrepreneurs realize the dream of business ownership and help existing businesses remain competitive in a complex, ever-changing global marketplace. SBDCs are hosted by leading universities and state economic development agencies, and funded in part through a partnership with Small Business Administration (SBA).

Public procurement policy

When comparing the public procurement policy of the EU and the U.S. what becomes obvious is that there are large differences. Traditionally EU programs have focused on a supply-side approach to research and innovation. Horizon 2020 increases the focus on demand-side policies aiming to pull innovation forward by offering incentives or rewards for the results of research and innovation. These policies work in combination with the supply-side policies, helping steer EU funded research into tangible outputs, beneficial for both EU citizens and businesses. In this respect it is supported through Public Procurement of Innovative Solutions (PPI) that involves public procurers acting as a launching customer or early adopter of a new product or service and through through Pre-commercial Procurement (PCP) which is used when there is no solution available - or close to being available - in the market. This involves procuring solutions that still require further research and development before they are commercially available. Thus, support for innovative public procurement is an important demand side policy under Horizon 2020 and pre-commercial procurement (PCP) is officially introduced as a new funding instrument to be used across all areas of research and innovation supported by the Commission.

In the U.S., there is no centrally coordinated innovation procurement policy. The Office of Management and Budget runs the Office of Federal Procurement Policy, which helps operate federal policies spending by federal agencies yearly on mission-related materials, supplies and services.

Although the U.S. does not have an official policy to use public procurement to promote private R&D, there are a few programs that use public procurement in this manner. Pre-commercial procurement through the SBIR program is among the most prominent longstanding demand-side programs in the U.S. This is also the case with defense procurements; defense procurement of transistors and aircraft has been important in stimulating the semiconductor and aerospace industries. For the most part, however, public procurement is not aimed at this effect.

Measuring policy effectiveness

Policy effectiveness in Europe is being monitored by programs' evaluations and impact assessment exercises. The European Union has a long standing evaluation culture and has formal procedures for evaluation and monitoring its research and innovation policies[143]. The progress and achievements of the various Innovation Union initiatives is presented regularly in a status report. The respective report of 2012 presented that there was quite some progress in implementing the Innovation Union with more than 80% of the IU commitments being on track with on-going initiatives. One area where there is need for more effort concerns the use of innovation procurement (i.e. adoption of the Single Market Act I proposals and rolling out the initiatives on the intellectual property valorization).

In the U.S., the most prominent recent assessment of innovation policy in the U.S. has been the "Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5" report released back in 2010. The report presented various statistics showing how the U.S. research and innovation position has declined relative to other countries. The report supported that in many cases, other countries in Europe and Asia have taken up the recommendations of the earlier report to a much greater extent than the U.S. In addition, the report highlighted weaknesses in H1-B visa granting[144], intellectual property laws, export control policies and the lack of permanence of the R&D tax credit.

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[143] For the EU Framework Program Evaluation and Monitoring, see: http://ec.europa.eu/research/evaluations/index_en.cfm

[144] The H-1B is a non-immigrant visa in the United States under the Immigration and Nationality Act, section 101(a)(15)(H). It allows U.S. employers to temporarily employ foreign workers in specialty occupations. If a

Cooperation in innovation – going international

The focus of the new International Cooperation strategy of the European Union focuses on research and innovation, in areas of common interest and mutual benefit following a strategic approach. International cooperation in research and innovation is an instrument of soft power and a mechanism for improving relations with key countries and regions. Good international relations facilitate effective cooperation in research and innovation. The Union's engagement with countries and regions across the globe will consequently lead researchers and innovators to engage on a stakeholder-driven basis with their counterparts worldwide.

There are several and strong connections between Europe and the U.S. with regards to innovation policy. There are a number of umbrella Science and Technology Agreements that have been set up between the U.S. and 37 countries of which Europe and European countries figure prominently while there is also an agreement at the EU level. At the level of individual policy measures, there exist some that allow third country participation. Joint-ventures and corporate internationalization are common features of the U.S. private sector but there aren't any specific targeted policies explicitly supporting international connections.

Thematic priorities

It is obvious when comparing the two innovation systems that there are many common priorities and some room for further enhancing the EU-US innovation collaboration. An important aspect is that both the EU and U.S. have specific policies focusing on clusters and what can be observed is that there are some similar trends in both sides of the Atlantic. An example being that in both the EU and the U.S. a Cluster Mapping initiative exists. The European Cluster Observatory (http://ec.europa.eu/enterprise/initiatives/cluster/observatory/index_en.htm) and the U.S. Cluster Mapping (http://clustermapping.us) respectively. In addition, recent cluster-focused grants such as the Economic Development Administration's Regional Innovation Grants in the US and the upcoming Horizon2020 action named "Cluster facilitated projects for new industrial value chains" seem to move towards the same direction.

Another strong connection is that it seems that DoE's set of Energy Innovation Hubs which were first established in 2010 and where currently four Hubs exist (Nuclear Energy Modeling & Simulation Hub, the Joint Center for Artificial Photosynthesis, the Joint Center for Energy Storage Research and the Critical Materials Institute) and the Knowledge and Innovation Communities (KICs) of the EU have a similar focus and work on the same or similar fields (Climate KIC, KIC InnoEnergy, EIT ICT Labs and as of December 2014 KIC RawMatTERS and the KIC InnoLife)

4.1.3 Suggestions to further support & enhance EU-U.S. innovation collaboration

Based on the literature review and the overview of the innovation policy systems as presented in the sections above, some policy suggestions have been formulated that could further improve S&T collaboration between EU and the U.S.

EU-U.S. S&T cooperation agreements

- The EU-U.S. S&T cooperation agreement is very important for facilitating the regular S&T policy dialogue between the European Community and the Government of the United States aiming to enhance the EU-U.S. S&T cooperation and the exchange of experience and good practice in the area of S&T policy. It could be useful to have an extension of the areas and forms of cooperation between the EU and the U.S. – based on an open dialogue involving all

foreign worker in H-1B status quits or is dismissed from the sponsoring employer, the worker must either apply for and be granted a change of status to another non-immigrant status, find another employer (subject to application for adjustment of status and/or change of visa), or leave the U.S. (source: Wikipedia - http://en.wikipedia.org/wiki/H-1B_visa) key stakeholders who could propose ideas, further thematic areas and also types of actions that could be included in an extended S&T cooperation agreement.

- As presented in the section 3 of the current report, there are a number of S&T cooperation agreements between the U.S. and individual EU member states. It would be very useful, if the respective international cooperation activities were monitored and recorded – e.g. in national inventories; through these inventories, the respective agreements could be reviewed, the thematic areas and forms of collaboration could be assessed, and the overall collaboration strategies at EU and U.S. levels could be reformulated (based on recorded good practices at the bilateral MS-U.S. level) to foster these collaborations more effectively[145].
- A key issue here could be that while at the top-management level there are agreements and Memoranda of Understanding (MOUs) between the EU and the U.S., this does not seem to be streamlined towards the funding programs level. For example, there is an MOU signed between the NIH and the EC, but the SBIR program does not fund participation of foreign SMEs in the program and at the same time, the SME instrument does not fund the participation of U.S. SMEs. A more elaborated approach on how the strategic level decisions and agreements can be translated into actions that can be implemented at the actual cooperation at program level would be very meaningful and would solve many problems (implementation-wise). A proposal could be that the EU-U.S. collaboration should allow joint projects, programs funded by respective countries.
- The cooperative definition of standards is another field of potential U.S. / EU innovation cooperation. The lack of uniform international standards can result in limiting the economic opportunities of companies with superior technologies because a multiplicity of standards can effectively result in a multiplicity of fragmented markets, the perspective of which often hinders investment into innovative technologies.
- An important element to be explicitly addressed as part of a future S&T cooperation would be to discuss and understand the implications of the difference in the approach towards innovation. Whereas the U.S. system focuses on market-driven innovation, the Europeans direct the innovation system towards certain goals. This has potentially implications on the form of cooperation agreements. Steps forward have been already implemented – for example, the recent BILAT USA 2.0 Innovation Conference "How to Integrate the Innovation Dimension in EU-US S&T agreement" was organized in Brussels on January 14-15, 2015[146]

Cooperation under the EU &U.S. funding Programs

- The main form of EU-U.S. S&T cooperation is notably the European Commission's Framework Program for Research and Technology (now H2020). It might be worthwhile considering the creation of more targeted programs or actions, directly focusing on supporting the EU and U.S. S&T Cooperation areas. These programs could focus on limiting the administrative or legal barriers for both EU and U.S. parties who wish to cooperate.
- As the new framework program for Research and Development has been launched earlier in 2014 (i.e. Horizon 2020), there is a need to enhance the visibility of the Program scope in the U.S. and thus further promote EU-U.S. S&T cooperation. The EU Delegation in the U.S. could play a major role in this, promoting activities in each U.S. state given the lack of designated NCPs (National Contact Points). At the same time, each individual member state should also make sure to provide adequate information through their NCPs on potential areas of S&T collaboration with U.S. partners.

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[145] Derek-Jan Fikkers and Manfred Horvat (Eds.): Basic Principles for Effective International Science, Technology and Innovation Agreements. European Commission, Directorate General for Research and Innovation, Directorate International Cooperation. 2014

[146] Presentations are available under http://www.euussciencetechnology.eu/content/bilat-usa-20-cordially-invites-you-eu-us-innovation-conference-14-15-january-2015-brussels#overlay-context=

- To enhance U.S. participation in European Programs and vice versa, it would be useful to organize training sessions for interested participants, where the programs will be explained from the application phase (how to write your proposal, how to find the right partner, etc.) to the implementation and reporting phase (financial and administrative rules, how to write the report, etc.). This would improve the understanding of the current rules applying and could probably decrease the level of discomfort for those not familiar with the processes.
- Although as seen in the literature review there is room for participation of U.S. partners in European research activities and vice-versa, there are still significant obstacles/ barriers that could be shifted. For example, the EU participation in U.S. programs is limited with regards to the role of the European partners and the respective funding they can receive. At the same time, U.S. participants also come across a number of important problems they need to tackle, especially at the administrative level. These aspects should be taken into account in the re-design process of programs to make sure they facilitate S&T cooperation. A proposal would be that in order to stimulate international cooperation, funding agencies should allow travel funding and exchange program funding to its respective researchers rather than directly funding third countries.
- Both the EU and the U.S. should set specific and measurable targets in terms of each other's participation in their S&T funded programs. The targets and cooperation models should be relevant to the number of participating organizations or individual researchers, the type of different programs selected, the specific results achieved, etc. This way it will be easier to monitor the actual participation and maybe track down participants to provide feedback on their participation, and thus assess the programs' impacts and the level of success.
- Following the new strategic approach of the EU towards international S&T cooperation areas for substantial jointly agreed flagship initiatives should be identified. The "Transatlantic *Arctic* and *Marine Research Initiative* " initiative is a step in the right direction.
- In the U.S. around 20% of the measures address social innovation goals such as society-driven challenges, capability development to foster greater equality in receipt of federal R&D funds between the states, and greater understanding of informal and formal societal environments for encouraging learning. In a future perspective, the EU could learn a lot from the U.S. in terms of best practices in the field of social innovation for example by looking in measures as the Science of Science and Innovation Policy (SciSIP) of the NSF. This measure furthers public sector innovation by stimulating research to understand the kinds of outcomes that can be expected from scientific investments.
- The Marie Curie actions are the strongest scheme in the EU-U.S. S&T cooperation. In the period 2007-2017, there were 1366 American researchers funded in Marie Curie Actions and 929 American organizations participating in the scheme. Overall, funding allocated during the period was EUR 0,626 million.[147] There should be more focus on such schemes for attracting more U.S. researchers to Europe.
- There are no **NCPs** in the US **for H2020** and a recommendation is that NCPs should be re-established as they are really important mechanisms.
- A real need to **mapping the help structures** was identified *(both transatlantic structures and national structures aiming at transatlantic exchanges/putting transatlantic businesses/organizations in contact)* . There is a need to review these structures and identify the gaps. Important are mapping bodies than can help connecting academic research/ research institutions with businesses on both side of the Atlantic, and move innovation to the market.
- A need to respond on the question: **how to find partners on the other side of the Atlantic?** – would be nice to have a **joint transatlantic body** which would be able to orientate businesses

[147] http://ec.europa.eu/research/mariecurieactions/funded-projects/statistics/index_en.htm , Latest statistics available since April 2014.

in their search of partners (notably inform regarding relevant partner search tools), inform on the main programs and opportunities for cooperation, give an overview of the research infrastructures, etc.. with both a European team and a US team.

- The **transatlantic Chamber of Commerce** as well as US- EU Member states chambers of commerce could play a role in the involvement of SMEs in RDI/innovation projects, notably by coaching SMEs. The idea of a Transatlantic Innovation Chamber, addressing different barriers was discussed during the BILAT USA 2.0 workshops and is also addressed in relevant literature, with the attribution of varying goals and activities. It was discussed that such body with the objective of **improving transatlantic technology transfer between academia and industry** would be very useful, with the idea that for an efficient technology transfer, a single structure could centralize technology transfer, linking the EU and US. It was suggested that such structure could be based on existing organizations, for example in the US on Massachusetts Biotechnology Council and in Europe on Inserm Transfert or an equivalent institution. In 2011, the Transatlantic Business Dialogue (TABD) mentioned in its paper "Accelerating the Transatlantic Innovation Economy"18 the idea of establishing a non-profit cross-Atlantic research and development facility, which would be called "Transatlantic Research and Development Institute" (TRDI), that could serve the purpose of enhancing the transatlantic research, development and innovation cooperation, acting as a foundation for transatlantic harmonization of research and development policies, and developing activities related to cost-sharing or Intellectual Property Rights. Such a dedicated structure could thus encompass different goals, yet remains focused on the global objective of enhancing transatlantic research, development and innovation cooperation, and centralize different activities linked to his goal.
- Expanding the **EUREKA program so as to include the U.S.** EUREKA is an intergovernmental organization for market-driven industrial R&D. It is a decentralized network facilitating the coordination of national funding on innovation as participants are funded by national budgets, aiming to boost the productivity & competitiveness of European industries. The network integrates over 40 pan-European economies, but also includes Israel, South Korea, and Canada, however not the U.S.

Reciprocity Principle

- In the new emerging internationalized research system, reciprocity and openness in research funding are extremely important. U.S. participation in FP7 is the most prominent in the themes of Health; Information and Communications Technologies (ICT); Food, Agriculture & Fisheries and Biotechnology (FAB); and Nanosciences, Nanotechnologies, Materials and Production Technologies (NMP). 75% of all Marie Curie International Outgoing Fellowship holders go to the U.S., while American researchers account for 14% of Marie Curie International Incoming Fellowships.[148] Currently, there is openness (as proven above) but reciprocal funding access arrangements exist only between the EU and the U.S. National Institutes of Health (FP7 & H2020) – "Zerhouni-Potocnik agreement" [149] - which is applicable only under the Health thematic area. It is essential that opportunities for similar approaches in other thematic areas should also be promoted through similar agreement between the responsible U.S. agencies or departments and the European Commission (not only through direct funding but also through hosting staff and students by bearing their costs in the host nation, paying for research instruments and laboratory costs in the host nations, etc.).

EEN – U.S.-EU Match role

- The role of EEN in Europe is extremely important and given the fact that it receives full support by the European Commission, it has established itself as the central mechanism for supporting small enterprises and start-ups. The services are offered for EU-U.S. collaboration

[148] http://ec.europa.eu/research/iscp/index.cfm?pg=usa
[149] http://www.fic.nih.gov/News/GlobalHealthMatters/Pages/Globalcollaborationsareessential.aspx

through the U.S.-EU Match [150] scheme already supported by the EEN and the European Commission through the CIP program. A major barrier for the implementation of the U.S.-EU Match is the fact that activities to support its use and promotion are not funded, whereas in the EU they are. Because of the lack of funding, it is very difficult to upgrade/ improve the web portal and there are very limited resources to be used for responding to all inquiries from EEN members (requirements often need time-intensive market research). Funding should be provided for the EEN and the U.S.-EU Match collaboration, to further promote and raise awareness of their activities and success stories in order to first, enhance their visibility and second to improve accessibility of those who are interested in getting more familiarized with the context of the services offered and the way they can get support for internationalizing their business activities on both sides of the Atlantic.

- Introducing further partners in the U.S. is important as the number of the current partners is not enough and there is a real call from European businesses to enlarge the EEN database with American organizations. Also, it was remarked that a number of countries support their EEN nodes from national sources, as this is considered strategically important to reinforce business and innovation collaboration between the countries. It is currently not the case in the U.S.

Internal Market Information (IMI) System

- Under EU single market laws, people and businesses have certain rights to move around the European Economic Area for work, study, trade, etc. In order to further facilitate collaboration between the EU and U.S., it might be appropriate to consider broadening the use for the U.S., in order to be able to identify but also share information regarding services, legal aspects, professional standards and qualifications, travels, studies, stay, etc. Currently, the requirements for work visas prevent U.S. citizens from finding EU jobs unless they find a sponsorship organization. This would simplify things and facilitate the process.

[150] http://www.us-eu-match.com/home.cfm

5 Conclusions

Based on the previous presentation of the research and innovation policy systems in the EU and the U.S., one may conclude that there are as many differences as there are similarities. Although the U.S. is a single nation and the EU consists of 28 member states, each one having a national identity and specific policy objectives, there is common ground and mutual benefits with regards to S&T and innovation policy collaboration.

In conclusion, when comparing the EU and the U.S. innovation systems, one can identify as many differences as there are similarities.

Both EU and the U.S. are amongst the global innovation leaders together with South Korea and Japan with China catching up. The global economic downturn has affected the formulation of innovation policies and related funding schemes shifting innovation policy priorities both in EU and the U.S.

Both the EU and the U.S. are open and keen on further promoting international cooperation in research and innovation in particular carefully identified areas of common interest, with some restrictions with regards to the participation and the level of funding for private sector companies.

There is an S&T cooperation agreement between the EU and U.S. since 1999. This was renewed three times: in 2004, 2009, and 2014. Since then, joint research activities are undertaken in a number of fields such as biotechnology, environment, materials science (including nanotechnology) and non-nuclear and renewable energy.

There are several aspects where there could be improvements in the patterns of collaboration between EU and the U.S. in the S&T and innovation collaboration. Indicatively, some of them could be:

- S&T cooperation agreements
- Cooperation patterns under the EU &U.S. funding Programs
- The reciprocity principle
- The EEN& EU-U.S. Match networks’ role
- The IMI system

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