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The regional perspective of the knowledge-based economy and Europe 2020

Abstract: In this research work, the author focuses on the analysis of the regional perspective of the knowledge-based economy and Europe 2020. The Europe 2020 programme is the European Union's growth strategy for the coming decade and especially for new budget perspective 2014–2020. In a changing world, representatives of the EU want it to become a smart, sustainable, and inclusive economy. These three mutually reinforcing priorities should help the EU and its Member States deliver high levels of employment, productivity, and social cohesion. Concretely, the Union has set five ambitious objectives — on employment, innovation, education, social inclusion, and climate/energy — to be reached by 2020. Each Member State has adopted its own national targets in each of these areas. Concrete actions at EU and national levels underpin this strategy. The main objective of the research task is to give a comprehensive analysis of the knowledge-based economy from the regional perspective and the program Europe 2020. The particular main concern is the increase of the importance of the knowledge-based economy in the region, the Triple Helix model constructed advantages, programme Europe 2020 and financial instrument of this programme — Horizon 2020.

Keywords: knowledge-based economy, regional development, Triple Helix model, constructed advantage, innovation policy, increase of education, Europe 2020, Horizon 2020

Regionalna perspektywa gospodarki opartej na wiedzy i „Europa 2020"

Abstrakt: W niniejszej pracy badawczej autor skupia się na analizie regionalnej perspektywy gospodarki opartej na wiedzy i programu „Europa 2020". W zmieniającym się świecie przedstawiciele UE chcą, aby UE stała się inteligentną, zrównoważoną gospodarką sprzyjającą włączeniu społecznemu. Te trzy wzajemnie wzmacniające się priorytety powinny pomóc UE i jej państwom członkowskim osiągnąć wysoki poziom zatrudnienia, wydajności i spójności społecznej. Mówiąc konkretnie, Unia wyznaczyła pięć ambitnych celów — w zakresie zatrudnienia, innowacji, edukacji, włączenia społecznego oraz klimatu/energii — do osiągnięcia w 2020 roku. Każde państwo człon-

kowskie przyjęło własne cele krajowe w każdym z tych obszarów. U podstaw strategii leżą konkretne działania na szczeblu unijnym i krajowym. Głównym celem zadania badawczego jest kompleksowa ocena gospodarki opartej na wiedzy z perspektywy regionalnej i programu „Europa 2020". Głównym celem artykułu jest ocena wzrostu znaczenia gospodarki opartej na wiedzy w regionie, budowanie przewagi w modelu Potrójnej Helisy, programu „Europa 2020" i finansowego narzędzia tego programu — Horyzont 2020.

Słowa kluczowe: gospodarka oparta na wiedzy, rozwój regionalny, potrójna helisa, budowanie przewagi, zrównoważona gospodarka sprzyjająca włączeniu społecznemu, produktywność i spójność społeczna, Europa 2020, Horyzont 2020

Introduction

Europe 2020 and the Innovation Union initiative have clearly signalled the EU's intention to rise to the challenge. Europe 2020 focuses on achieving smart growth, while the Innovation Union sets out measures to contribute to this aim, including increasing investment, refocusing R&D and innovation policy on major societal challenges, and strengthening the links from frontier research right through to commercialisation. A key challenge for the EU in implementing its strategy will be to build a next-generation expenditure programme which matches this level of ambition in both its budget and its aspirations.

The challenges facing the European Union economy continue to be daunting. In particular, several Member States' economies continue to face large deleveraging of the private and public sectors. This deleveraging reflects the unwinding of accumulated financial imbalances linked to previous unsustainable expenditure levels financed by credit, in some cases promoted by asset price bubbles in the private sector and in others by the lack of fiscal rigour in the public sector. This is now weighing on growth, as spending is reduced and income directed to debt repayment.

On the positive side, there are signs that the adjustment in EU economies is progressing. The financial market situation has improved after the summer on the back of the steady implementation of the reform agenda, including the advancements in the European Monetary Union (EMU) architecture, and by the important policy decisions in the euro area, including by the European Central Bank (ECB). The significant reform efforts in vulnerable Member States are also bearing fruit: leveraging has decreased in the private and public sectors and competitiveness is improving in countries with large competitiveness gaps creating conditions for further adjustment going forward. Exports are contributing increasingly to improvements in large current account deficits, which bodes well for the lasting nature of the correction. The large growth differences among the EU countries are also a reflection of the ongoing adjustment: temporary lower or negative growth is often a feature of deep adjustments, but they open the way for more sustainable growth and convergence.

The increase of the importance knowledge-based economy in the region

According to the new theory of growth being the best theoretical foundation for the concept of the innovation system, the primary factor influencing economic growth is endogenous technical progress. In endogenous theories workers are seen as an element capable of active interaction and creating changes in the production process, and therefore a huge role in increasing productivity is ascribed to human capital and knowledge. It was Schumpeter who first recognised the importance of knowledge in the economy by his reference to "new combinations of knowledge" at the heart of innovation and entrepreneurship (Schumpeter, 1911, p. 57). Nonaka & Takeuchi (1995) also show that Marshall (1916) recognised that: "Capital consists in a great part of knowledge and organisation… knowledge is our most powerful engine of production… organisation aids knowledge" (p. 115).

Typically, however, neoclassical economics neglected what was not contained in price information and made no effort to add to economic knowledge by trying to measure its economic contribution. Thereafter, Hayek (1945, 1948) identified "the division of knowledge as the really central problem of economics as a social science" (1948, p. 51) and saw its key question how localised knowledge held by fragmentary firms and individuals nevertheless produces an ordered market demand and supply. "The most significant fact about this system is the economy of knowledge with which it operates, or how little the individual participants need to know in order to be able to take the right action. In abbreviated form, by a kind of symbol, only the most essential information is passed on, and passed on only to those concerned" (Hayek, 1948, p. 86).

A further progenitor of the view that knowledge is a most important economic resource was Penrose (1959). She founded what has now evolved into the "dynamic capabilities of firms" approach to microeconomics (Teece & Pisano, 1996). She referenced the firm's characteristics as an administrative organisation (after Marshall, 1916; Coase, 1937) and home to accumulated human and material resources. The latter are inputs to services rendered, and these are the product of the firm's accumulated knowledge. "A firm's rate of growth is limited by the growth of knowledge within it, but a firm's size by the extent [of] administrative efficiency" (Penrose, 1995, p. 240). In effect, in the words of Nonaka & Takeuchi (1995), "the firm is a repository of knowledge'(p. 34). Penrose (1995) also acknowledged that had the term been available in the 1950s, she would have referred to the dynamic capabilities of firms residing in knowledge networks (Quéré, 2003). Thus, Penrose (1995) noted the following crucial feature of the massively increased value of transferable knowledge to the wider economy for the firm. "The rapid and intricate evolution of modern technology often makes it necessary for firms in related areas around the world to be closely in touch with developments in the research and

innovation of firms in many centres" (Penrose, 1995, p. 242). Importantly, Penrose continues, the rise of business knowledge networks represents a metamorphosis in the contemporary economy. The key to the knowledge-based economy is at least partly revealed as this metamorphosis in the nature of industry organisation to facilitate interaction with valuable knowledge, and not to conceal it, as was common in the previous phase of the global economy (Cooke & Leydesdorff, 2006).

Whereas the concept of a "knowledge economy" emerged within the context of the economic analysis of the quality of the input factors in the production process (Schumpeter, 1939), the term "knowledge-based economy" finds its roots in more recent discussions from a systems perspective (e.g. Sahal, 1981, 1985). National governments, for example, need a systems perspective for developing science, technology, and innovation policies (Nelson, 1982). The modern approach to innovation, namely the so-called chain model, underlines the complexity of the innovation process and the uncertainty of its results, which increase often the need to return to the earlier stages. The chain model shows at the same time that applied research may lead to fundamental discoveries, which means that innovation of companies depends on the quality of relations between other companies that generate knowledge and innovation in the economy (Wójnicka, 2008). Companies are a critical element in the innovation system, and their health determines the competitiveness of countries and social well-being.

By the second half of the 1950s, it had become increasingly clear to both policy makers and economic analysts that the continuing growth rates of Western economies could no longer be explained in terms of traditional economic factors such as land, labour, and capital. The "residue" (Abramowitz, 1956; OECD, 1964) had to be explained in terms of the upgrading of the labour force, surplus generated by interaction effects, and more generally the role of knowledge in the economy (Rosenberg, 1976). The Organisation for Economic Co-operation and Development (OECD) was created in 1961 in order to organise and to coordinate science and technology policies among its member states, that is, the advanced industrial nations. This led in 1963 to the Frascati Manual in which parameters were defined for the statistical monitoring of science and technology on a comparative basis (Cooke & Leydesdorff, 2006).

It is a short step to link insights like these to the earliest work to operationalise a notion of the "knowledge economy" arising from the pioneering work conducted by Machlup (1962). He sought to identify these sectors with a heavy concentration of knowledge assets. He next attempted to map the production and distribution of knowledge sectors in the United States economy. Machlup classified knowledge production into six major sectors: education, R&D, artistic creation, communications media, information services, and information technologies. He showed that these account for the largest sectoral share of GDP and employment in the economy, and predicted that this share was destined to grow both absolutely and relatively over time. With brief interventions from Eliasson et al. (1990) and Bur-

ton-Jones (1999) who further specified the knowledge intensity of sectors by value and labour qualifications respectively, based on statements of the Organisation for Economic Cooperation and Development (1996, 1999) calling for the measurement of the knowledge-intensity of national and regional economies (OECD/Eurostat, 1997).

The research into innovations in companies conducted in the Community Innovation Survey I in European Union member states have demonstrated that there is much more interaction and cooperation among the elements of the innovation system that occurs at the level of the region than the country. This results in the emphasis in recent years on research of potential and regional innovation systems. In response to the need and assuming greater efficiency of the actions taken nearer to the entities, most regions that possess their own local authorities create their own policy and pro-innovation strategy. The reflection of the importance of the regional level for the innovation process are the European Union programmes supporting the creation of regional innovation strategies — RIS, regional initiatives for innovation and technology transfer — RITTS, and similar national programmes as e.g. InnoRegio in Germany ("Economic Bulletin", 2002).

This regionalisation is to extract the spatial units of relatively homogeneous characteristics (geographical, demographic, cultural, economic) in order to ensure the proper growth pace for regions by giving them a specific amount of self-control. This causes a problem of the content-relation nature of the topics under the freedom of decision-making. Among the regions that are weak and strong, crucial and peripheral, stagnant and developing, we distinguish border regions called also cross-border regions. Their particularity is that they are situated along the borders separating two or more adjacent countries. In view of the processes of globalisation, the role of regional cooperation will increase. In the future, corporatism and regionalism may become the dominating factors in the development of the world economy.

Studies of the knowledge-based economy focus not only on human capital, but also on the sectoral characteristics of the knowledge factor (Nelson, 1982; Pavitt, 1984). Technological trajectories and regimes shape innovation systems, but with a dynamics different from those of economic or geographical factors (Nelson & Winter, 1982). The recombination of the economic dynamics of the market, the dynamics of knowledge-based innovation, and governance generates the systems perspective. An innovation system can then be defined at the national level (Freeman, 1987, 1988; Lundvall, 1988, 1992; Nelson, 1993), at the regional level (Cooke, 1992; Cooke et al. 2004), or in terms of a dynamic model like the Triple Helix of university-industry-government relations (Etzkowitz & Leydesdorff, 2000; Leydesdorff, 1994).

The general argument about the salience of the organisation of knowledge in the sectoral, skills, and spatial composition of the economy embraces the position of Castells (1996), who is widely known for the observation that productivity and

competitiveness are, by and large, a function of knowledge generation and information processing, and that this has involved a Penrose-type metamorphosis entailing a different mode of thinking about economies. Thus the balance between knowledge and resources has shifted so far towards the former that knowledge has become by far the most important factor determining standards of living — more important than land, capital, or labour. Today's most advanced economies are fundamentally knowledge-based (Dunning, 2000). Even neoclassicists like Paul Romer recognise that technology (and the knowledge on which it is based) has to be viewed as an equivalent third factor along with capital and land in leading economies (Romer, 1990). Inevitably this leads to issues of the generation and exploitation of knowledge. How is the system of knowledge production organised and controlled? (Whitley, 1984, 2001; Leydesdorff, 1995).

In a knowledge-based economy, inequality is generated by mechanisms of inclusion and exclusion only partially overlapping those of a traditional (capitalist) economy. With less emphasis, one can also say that another variant of capitalism is induced (Hall & Soskice, 2001). The mechanisms of inclusion and exclusion are no longer tightly coupled to one's class position in the production process as in an industrial economy. The geographical component can be expected to play an independent role in knowledge-based dynamics because the newly emerging system is grounded in communication networks (Cooke & Leydesdorff, 2006).

It is important to underline that the core city moves away statistically from the periphery, in the intensity with which it accumulates knowledge-based activities. Simultaneously, new high technology satellite towns "swarm", to use a Schumpeterian term, around the mother city. Even static analysis reveals this pattern, with some satellites scoring much higher than the main city around which they aggregate. Peripheral islands and regions or localities may score as low as 37% of the index average of 100% compared to 157% for Stockholm (e.g. Aegean Islands in the EU context; Cooke & De Laurentis, 2002; Dannell & Persson, 2003). Compared to GDP disparities a five-to-one ratio in the knowledge economy measure is approximately twice that given by measuring economic welfare differences more conventionally (Cooke & Leydesdorff, 2006).

Hence, for the industries of the future, the core cities are highly privileged in most countries while the peripheries are generally impoverished and becoming more so, presaging major out-migration of youth and the metamorphosis of such areas into socially deserted or playground economies. The policy imperative to devise mechanisms by which non-metropolitan regions may, in future, participate in the knowledge-based economy is clearly overwhelming.

In the view of the new theory of economic growth developed by such researchers as Kenneth Arrow, Paul Romer, and Robert Lucas, knowledge is the primary factor in determining productivity. According to the new theory of growth being the best theoretical foundation for the concept of the innovation system, the primary factor influencing economic growth is endogenous technical progress. In

endogenous theories, workers are seen as an element capable of active interaction and creating changes in the production process, and therefore a huge role in increasing productivity is ascribed to human capital and knowledge.

The Triple Helix model constructed advantages

An efficient innovation system introducing innovation and competitiveness of companies must have the proper linkages between science and industry. The scientific and technical policies of the countries moving towards the knowledge based economy favour the linkage between universities and industry. At the same time, the science sector should fall within the network of links with local, regional, national, and foreign partners. As a result of such activity the boundaries between institutions shall disappear, and the entire system becomes more dynamic. National policy can affect the science sector more than companies, so stronger links between science and industry can be inspired by the reform of the educational system.

It has been suggested that the idea of an absolute advantage in foreign trade originates with Adam Smith and developed by Ricardo and Torrens to comparative advantage and after was developed by Marshall and Ohlin. Foray & Freeman (1993) re-introduced, yet scarcely explored it. More attention has been devoted to it in comparison to other well-known forms of economic advantage by De la Mothe & Mallory (2003), as follows:

— Comparative Advantage — Regions have been a focus for economists who viewed them through the lens of development economics usually set in a framework of comparative advantage. This idea, deriving from David Ricardo and trade theory, explained economic welfare in terms of initial resource endowments traded between regions and nations. Thus, cotton goods enjoying a comparative production advantage from mercantile and climatic conditions in northwest England were traded with Port wine from Portugal's Norte region, enjoying a comparable mercantile and climatic comparative advantage. While policies were not excluded from such an analysis, they mainly added up to forms of mercantilism, and Ricardo advocated intervention regarding technological change. The overwhelming framework which government policy gave rise to and which promoted comparative advantage was laissez-faire (Cooke & Leydesdorff, 2006).

— Competitive Advantage — By the mid-1970s, visible cracks were appearing in the economic models and frameworks that characterise pure comparative advantage. Thus countries with a large labour supply would naturally export goods that were labour-intensive (e.g. China), while countries that were technologically advanced (e.g. the United States) produced and exported technologically advanced products. The paradox arose when advanced economies exported labour-intensive goods as well as technologically intensive goods. The key weakness was the failure

to acknowledge technological process change as well as product innovation as being endogenous to economic growth. Krugman (1995) and Porter (1990, 1998) noted the competitive advantage of firms in which distributed supply chains and the role of large domestic markets became accepted, and saw this advantage as central to explanations of inter-firm and firm-market success. Intra-industry trade and localised demand conditions for market competitiveness were highlighted. But no explanation was offered for why some regions prosper while others do not. The emphasis on markets meant that funding and policy support by the public sector was largely ignored (Cooke & Leydesdorff, 2006).

— Constructed Advantage — The analytic observations of the two preceding perspectives do not embrace the new dynamics of innovation and the capacity to exploit them which are essential to growth. The "new competitive advantage" (Best, 2001) highlights regional development economics, the dynamic of which draws upon constructed advantage. This knowledge-based construction requires interfacing developments in various directions:

— Economy — regionalisation of economic development; "open systems" inter-firm interactions; integration of knowledge generation and commercialisation; smart infrastructures; strong local and global business networks.

— Governance — multi-level governance of associational and stakeholder interests; strong policy-support for innovators; enhanced budgets for research; vision-led policy leadership; global positioning of local assets.

— Knowledge infrastructure — universities, public sector research, mediating agencies, professional consultancy, etc. have to be actively involved as structural puzzle-solving capacities.

— Community and culture — cosmopolitanism; sustainability; talented human capital; creative cultural environments; social tolerance. This public factor provides a background for the dynamics in a Triple Helix of university-industry-government relations (Leydesdorff & Etzkowitz, 2003).

Hence, constructed advantage is both a means of understanding the noted metamorphosis in economic growth activity and a strategic policy perspective of practical use to business firms, associations, academics, and policy makers. In the Triple Helix model constructed advantages have been conceptualised as the surplus value of an overlay of relations among the three components of a knowledge-based economy: (1) the knowledge-producing sector (science), (2) the market, and (3) governments. Those places with research universities witness a growing demand for knowledge transfer to industry and, through government, to society (Etzkowitz & Leydesdorff, 1998; Etzkowitz et al. 2000). Moreover, the spread of universities is reasonably uniform in advanced industrial countries. For research knowledge, industry and government can be expected to pay more for privileged access to knowledge-based growth opportunities by funding research, stimulating closer interactions among the three institutional partners, subsidising infrastructure (e.g.

incubators and science parks), and stimulating academic entrepreneurship skills and funding (Cooke & Leydesdorff, 2006).

Early work on regional innovation systems (Cooke, 1992; Cooke & Morgan, 1994) attempted to capture the integrative and interactive nature of the knowledge-based economy examined from the regional perspective. The list of networking partners includes base institutions such as universities, research laboratories, research associations, industry associations, training agencies, technology transfer organisations (TTOs), specialist consultancies, government development, technology and innovation advisory agency programme-funding, and private investors. This knowledge exploration, examination, and exploitation base supports the innovation efforts of large and small firms in many industries. Not all interactions are only intra-regional; many are also national and global, but in the most accomplished regional economies like Baden-Württemberg, a majority of such institutional networking interactions were regional, and on such regular terms that the networking had become systemic (Cooke, 2001).

It may conclude that as the base of knowledge evolves institutionally, an increasing portion of the economy becomes knowledge-intensive. One key difference, however, is that science-based industries like genomics, research, software, and nanotechnologies generate value from producing analytical knowledge while most others create value from exploiting synthetic or symbolic knowledge. Thus, the old definition of knowledge economy in terms of a few important and growing sectors is redundant, while the structural idea of a knowledge-based economy linking the knowledge generation sub-system (mainly laboratory research) to the knowledge-exploitation system (mainly firms and, say, hospitals or schools) via technology transfer organisations in regional innovation systems is analytically useful (Cooke & Leydesdorff, 2006).

The effect of the growth in importance of regional (and other) innovation systems is to pervade regional and other economies with scientific, synthetic, and symbolic knowledge to a greater extent than ever before. The organisation of pure and applied knowledge can increasingly pervade the economy when scientific and technological knowledge is institutionally produced and systematically controlled. R&D management and S&T policies at relevant government levels enlarge the set of options. These, however, are not fixed but, evolving distributions in which some regions are more developed as knowledge-based economies than others. Hence the post-1970s fascination with "high-tech" regions worldwide. Today, however, as the Triple Helix perspective suggests, with universities and their related research laboratories spread throughout most regions, many more economies have the chance to access not only yesterday's "global" knowledge announced on the Internet and exploitable by all, but local knowledge of potentially high value generated from research conducted in relation to regional capabilities. Thus, as the knowledge base becomes pervasive, the knowledge economy is further reinforced (Cooke & Leydesdorff, 2006).

The Triple Helix challenge is picked up also in an attempt to identify the factors that affect the ability of universities both to create new knowledge and to deploy that knowledge in economically useful ways and thereby contribute to economic growth and prosperity. It seems therefore that constructed advantage based on regional innovation systems that transceive over long distances as well as through regional networks is becoming the model of choice for achieving accomplished regional economic development. Leydesdorff argues that the knowledge base of an economy can be considered as a second-order interaction effect among Triple Helix interfaces between institutions and functions in different spheres. Proximity enhances the chances for couplings and, therefore, the formation of technological trajectories. In this manner, connections between regional innovation systems and markets (an understudied aspect in the broad field of innovation studies) may be facilitated (Cooke & Leydesdorff, 2006).

The key driver of the problems is Europe's structural innovation gap: compared to its competitors, Europe's patenting performance is weak and it lags behind in developing new products, new processes, and new services. To boost productivity and growth, it is critically important to generate breakthrough technologies and translate them into new products, processes, and services. Europe has taken an early technological lead in many key technology areas, but in the face of growing competition its advantage is tenuous, and has not translated into an innovative and competitive lead. A timely and targeted European policy is needed for bridging the "valley of death" if Europe is to remain competitive (SEC 1428 final 2011).

This key driver is underpinned by the following structural problem drivers:

— Insufficient contribution of research and innovation to tackling societal challenges;

— Insufficient technological leadership and innovation capability of firms;

— The need to strengthen the science base;

— Insufficient cross-border coordination.

The EU recognises the urgency of the situation, and is responding with new policy strategies. An efficient innovation system introducing innovation and competitiveness of companies must have the proper linkages between science, industry, and governance. This requires a change in attitudes of companies to this cooperation as well as the reform of the public sphere of research and development in the direction of greater adjustment of its research and of the directions and methods of education to the needs of the economy. The scientific and technical policies of the countries moving towards the knowledge based economy favour the linkage between universities, industry, and governance, competitive and based on cooperation forms of funding scientific research, which is to strengthen the functions of learning in supporting and generating innovation. At the same time, the science sector should fall within the network of links with local, regional, national and foreign partners. As a result of such activity the boundaries between institutions shall disappear, and the entire system becomes more dynamic. National

policy-governance can affect the science sector more than companies, so stronger links between science, industry, and governance can be inspired by the reform of the educational system.

Europe 2020

It is important underline that the Innovation Union is one of the seven flagship initiatives of the Europe 2020 strategy for a smart, sustainable, and inclusive economy. The Innovation Union plan contains over thirty action points, with the aim to do three things:

— make Europe into a world-class science performer;

— remove obstacles to innovation — like expensive patenting, market fragmentation, slow standard-setting and skills shortages — which currently prevent ideas getting quickly to market; and

— revolutionise the way the public and private sectors work together, notably through Innovation Partnerships between the European institutions, national and regional authorities, and business.

The Innovation Union is the European Union strategy to create an innovation-friendly environment that makes it easier for great ideas to be turned into products and services that will bring economy growth and jobs (Table 1).

Table 1. GDP trends in the EU: levels and rates

	2006	2007	2008	2009	2010	2011	2012	2013	2014
GDP level (2007 = 100	96.8	100	100.3	96	98.1	99.6	99.3	99.4	101
GDP rate (annual)	+3.3	+3.2	+0.3	-4.3	+2.1	+1.5	-0.3	+0.1	+1.6

Source: Growth, competitiveness and jobs priorities for the European Semester 2013. Presentation of J.M. Barroso, President of the European Commission to the European Council of 14–15 March 2013, http://ec.europa. eu/news/pdf/sg. 2013-00286-01-04-eu. tra-00.pdf (accessed: 24.01.2014).

The European semester (a mechanism for coordinating European economic and financial policy in six-month cycles) for economic policy coordination, which ensures Member States align their budgetary and economic policies with the Stability and Growth Pact and the Europe 2020 strategy. It is the basis for building a common understanding about the priorities for action at the national and EU level as the EU seeks to return to a path of sustainable growth and job creation.

The Annual Growth Survey should feed into national economic and budgetary decisions, which Member States will set out in Stability and Convergence Programmes (under the Stability and Growth Pact) and National Reform Programmes (under the Europe 2020 strategy) in April 2013.

It must be emphasised that the EU economy is slowly starting to emerge from the deepest financial and economic crisis in decades. However, although important action has already been taken and positive trends are beginning to emerge, to remain some distance from a recovery (Table 2). To restore confidence and return to growth, it is essential that Member States maintain the reform momentum, and for this reason the Commission recommends focusing on the same five priorities that were identified in last year's Survey:

— Pursuing differentiated, growth-friendly fiscal consolidation;
— Restoring normal lending to the economy;
— Promoting growth and competitiveness for today and tomorrow (Table 2);
— Tackling unemployment and the social consequences of the crisis;
— Modernising public administration.

Table 2. Global competitiveness index 2012–2013

Rank	Country	Rank	Country	Rank	Country
1	Switzerland	16	Austria	47	Malta
2	Singapore	17	Belgium	49	Portugal
3	Finland	21	France	55	Latvia
4	Sweden	22	Luxembourg	56	Slovenia
5	Netherlands	27	Ireland	58	Cyprus
6	Germany	34	Estonia	60	Hungary
7	United States	36	Spain	62	Bulgaria
8	United Kingdom	39	Czech Republic	71	Slovak Republic
9	Hong Kong SAR	41	Poland	78	Romania
10	Japan	42	Italy	81	Croatia
12	Denmark	45	Lithuania	96	Greece

Source: Growth, competitiveness and jobs priorities for the European Semester 2013. Presentation of J.M. Barroso, President of the European Commission to the European Council of 14–15 March 2013, http://ec europa. eu/news/pdf/sg. 2013-00286-01-04-eu. tra-00.pdf (accessed: 24.01.2014).

The deleveraging and adjustment process is inevitable and the main task of policy makers is to manage it and alleviate the associated economic and social consequences. Fiscal adjustment has to continue along the path of a differentiated growth-friendly consolidation strategy in view of the high debt levels and long-term challenges to public finances. However, as fiscal consolidation can have negative growth effects in the short term, it should be conducted in a growth-friendly manner, that is:

— the speed of consolidation has to be differentiated across countries according to their fiscal space, to strike the right balance between potential negative growth effects and the risks to debt sustainability. The Stability and Growth Pact and the

central role of structural budget balances therein offer the appropriate framework to guide the differentiated speed of adjustment;

— while focusing the consolidation on the expenditure side, there is a need to devise an overall growth-friendly mix of revenue and expenditure, with targeted measures within available fiscal space to protect key growth drivers while ensuring efficiency of expenditure.

Additionally, credibility of consolidation and its positive effects are enhanced if it is anchored in a credible medium-term fiscal framework and accompanied by reforms addressing the long-term sustainability issues stemming from an ageing population COM 750 final (2012).

Horizon 2020

Science and innovation are key factors that will help Europe to move towards smart, sustainable, inclusive growth, and along the way to tackle its pressing societal challenges. But Europe suffers from a number of critical weaknesses in its science and innovation system which contribute to the above problem. The EU's right to act is set out in the Treaty on the Functioning of the European Union and its objectives are cited under Article 179 and Article 180 (for research) and in Article 173 for the competitiveness of industry. The European Atomic Energy Community Programme (2014–2018) complementing Horizon 2020 has its legal basis in the Euratom Treaty (see in particular Article 7) (SEC 1428 final 2011).

Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. Running from 2014 to 2020 with a budget of just over €70 billion, the EU's new programme for research and innovation is part of the drive to create new growth and jobs in Europe.

Horizon 2020 provides major simplification through a single set of rules. It will combine all research and innovation funding currently provided through the Framework Programmes for Research and Technical Development, the innovation related activities of the Competitiveness and Innovation Framework Programme (CIP) and the European Institute of Innovation and Technology (EIT).

The proposed support for research and innovation under Horizon 2020 will:

— Strengthen the EU's position in science with a dedicated budget of € 24 341 million. This will provide a boost to top-level research in Europe, including the very successful European Research Council (ERC).

— Strengthen industrial leadership in innovation budgeted at € 17 015 million. This includes major investment in key technologies, greater access to capital and support for SMEs.

— Provide € 30 956 million to help address major concerns shared by all Europeans, such as climate change, developing sustainable transport and mobility,

making renewable energy more affordable, ensuring food safety and security, or coping with the challenge of an ageing population.

In the context of these problems the indication of a time line for horizon 2020 is worthy of note. This time line includes:

— Preparatory work in ITRE — Industry, Research & Energy Committee (EU Parliament): September/October 2013;

— Vote on the Multiannual Financial Framework (MFF) in the EP Plenary: September/ October 2013;

— Vote on Horizon 2020 in EP Plenary: October/November 2013;

— Adoption by the Council: November/December 2013;

— Adoption of work programme and publication of first calls for proposals: 11th December 2013;

— Horizon 2020 national launch events: October 2013 to January 2014.

Horizon 2020 is being adopted using the "ordinary legislative procedure" (formerly known as "co-decision"). It must be emphasised that Horizon 2020 will tackle societal challenges by helping to bridge the gap between research and the market by, for example, helping innovative enterprises to develop their technological breakthroughs into viable products with real commercial potential. This market-driven approach will include creating partnerships with the private sector and Member States to bring together the resources needed.

International cooperation will be an important cross-cutting priority of Horizon 2020. In addition to Horizon 2020 being fully open to international participation, targeted actions with key partner countries and regions will focus on the EU's strategic priorities. Through a new strategy, a strategic and coherent approach to international cooperation will be ensured across Horizon 2020. Horizon 2020 will be complemented by further measures to complete and further develop the European Research Area by 2014. These measures will aim at breaking down barriers to create a genuine single market for knowledge, research, and innovation.

The new growth strategy of the EU's necessity for public intervention, subsidiarity and European Added Value must be emphasised. There is a clear case for public intervention to tackle the problems above. Markets alone will not deliver European leadership. Large-scale public intervention through both supply and demand measures will be needed to overcome the market failures associated with systemic shifts in basic technologies. However, Member States acting alone will not be able to make the required public intervention. Their investment in research and innovation is comparatively low, is fragmented and suffers from inefficiencies — a crucial obstacle when it comes to technological paradigm shifts. It is difficult for Member States on their own to accelerate technology development over a sufficiently broad portfolio of technologies, or to tackle the lack of transnational coordination.

As highlighted in the proposal for the next Multi-annual Financial Framework, the EU is well positioned to provide added value, through measures to coordinate

Table 3. Unemployment rate and numbers of unemployed, overall and among young people (under 25) (December 2012)

	Unemployment rates in % (total population)	Number of persons unemployed (rounded)	Youth unemployment rates in %	Number of young unemployed (rounded)
EU	10.7	25 926 000	23.4	5 702 000
BE	7.5	368 000	20.0	85 000
BG	12.3	411 000	27.5	69 000
CZ	7.5	394 000	21.0	78 000
DK	8.0	233 000	14.7	65 000
DE	5.3	2 236 000	8.0	362 000
EE	9.9	68 000	19.5	13 000
IE	14.7	316 000	30.2	68 000
EL	26.8	1 346 000	57.6	181 000
ES	26.1	5 972 000	55.6	957 000
FR	10.6	3 123 000	27.0	794 000
IT	11.2	2 875 000	36.6	610 000
CY	14.7	66 000	28.5	12 000
LV	14.1	146 000	31.7	32 000
LT	12.3	187 000	23.6	31 000
LU	5.3	13 000	18.8	3 000
HU	10.9	476 000	27.9	87 000
MT	6.7	13 000	15.7	5 000
NL	5.8	520 000	10.0	144 000
AT	4.3	188 000	8.5	51 000
PL	10.6	1 845 000	28.4	436 000
PT	16.5	897 000	38.3	174 000
RO	6.5	661 000	23.0	194 000
SI	10.0	102 000	26.9	22 000
SK	14.7	405 000	35.9	85 000
FI	7.7	206 000	18.9	63 000
SE	7.8	395 000	23.9	154 000
UK	7.8	2 474 000	20.5	938 000

Source: Growth, competitiveness and jobs priorities for the European Semester 2013. Presentation of J.M. Barroso, President of the European Commission to the European Council of 14–15 March 2013, http://ec europa. eu/news/pdf/sg. 2013-00286-01-04-eu. tra-00.pdf (accessed: 24.01.2014).

national funding, which restructure more efficiently the European research and innovation landscape, and through implementing collaborative research and mobility actions, which generated critical mass (SEC 1428 final 2011).

A next generation programme should build on the experience from past Framework Programmes for Research and Technological Demonstration (FP), the Competitiveness and Innovation Programme (CIP), and the European Institute of Technology and Innovation (EIT). It is important to underline that over several decades, EU programmes have funded Europe's best researchers and institutes, and produced large-scale structuring effects, scientific, technological and innovation impacts, micro-economic benefits, and downstream macro-economic, social and environmental impacts for all EU Member States. However, important lessons can be learned from the past, including academic insights and stakeholder feedback. Research, innovation and education should be addressed in a more coordinated manner and research results better disseminated and valourised into new products, processes and services. Education and skills are especially key for increasing innovation levels and creating new jobs (Table 3). The intervention logic should be more focused, concrete, detailed, and transparent. Programme access should be improved and participation increased from start-ups, SMEs, industry, lower performing Member States and extra-EU countries (SEC 1428 final 2011).

Monitoring and evaluation need to be strengthened. In order to tackle the problems identified above, the following objectives have been set. The general objective of the next EU spending programme for research and innovation will be to contribute to the objectives of the Europe 2020 strategy and to the completion of the European Research Area.

In order to achieve this general objective, there are five specific objectives:

— Strengthen Europe's science base by improving its performance in frontier research, stimulating future and emerging technologies, encouraging cross-border training and career development, and supporting research infrastructures;

— Boost Europe's industrial leadership and competitiveness through stimulating leadership in enabling and industrial technologies, improving access to risk finance, and stimulating innovation in SMEs;

— Increase the contribution of research and innovation to the resolution of key societal challenges;

— Provide customer-driven scientific and technical support to Union policies;

— Help to better integrate the knowledge triangle — research, researcher training, and innovation.

The options considered were designed and evaluated in relation to stakeholders' views, the problems and the objectives above. They take into account some key parameters set out in the EU budget review: the need to focus on instruments with proven European added value, to develop a more results-driven approach, to leverage other public and private funding, and to design EU instruments that work together in a single strategic framework.

This Impact Assessment considers four policy options:

Business-as-usual (BAU): maintaining the current plurality of programmes for R&D and innovation: In this scenario, the three main existing EU sources of funding for research and innovation — FP7, the innovation-related part of the CIP, and the EIT — are simply carried forward into the next multiannual financial framework as separate instruments, and in their current formats.

Improved business-as-usual: loose integration and stand-alone simplification (BAU+): In this scenario, FP7, the innovation-related part of the CIP, and the EIT remain separate instruments and retain their current formats but are put together under a "common roof"; loose coordination mechanisms are established between them. The implementing modalities of each programme are simplified separately, but no single set of simplified rules, funding schemes, support services etc. applies across the three programmes.

Horizon 2020 — Establishing a single strategic framework for Research and Innovation: In this scenario, FP7, the innovation-related part of the CIP, and the EIT are fully integrated into a single unitary framework: Horizon 2020, The Framework Programme for Research and Innovation. The current separation between research and innovation activities is eliminated. Horizon 2020 sets out three strategic policy objectives: raising and spreading the levels of excellence in the research base; tackling major societal challenges; and maximising competitiveness impacts of research and innovation. Horizon 2020 is structured around three priorities which link directly to these aims. The selection of actions and instruments is driven by policy objectives and not by instruments. Horizon 2020 also integrates a major simplification and standardisation of funding schemes and implementing modalities across all areas.

Bring to an end EU level R&D financing and re-nationalise R&D and innovation policies: The renationalisation option consists of discontinuing EU research and innovation programmes and of spending these funds at Member State level. A discontinuation option, which is assessed to a lesser extent, consists of discontinuing EU research and innovation programmes and not spending these funds at Member State level either (SEC 1428 final 2011).

Interesting is to indicated how the options were compared. The four policy options were compared along a range of key parameters relevant to assessing public intervention in research and innovation:

— clarity of focus of the intervention;

— quality of the intervention logic;

— extent to which the intervention achieves critical mass at both programme and project level;

— extent of flexibility associated with the intervention;

— extent to which it promotes excellence;

— accessibility and reach;

— degree of stakeholder support;
— impact on SMEs;
— extent to which the intervention promotes knowledge triangle and broader horizontal policy coordination;
— impacts of the intervention — structuring, leverage, innovation, economic and competitiveness, social, environmental, and EU policy impacts;
— cost-effectiveness.

The comparison along these parameters was done using a range of evidence including: ex post evaluations; foresight studies; analyses of FP and Community Innovation Survey data; science, technology and innovation indicators; econometric modelling; reviews of academic literature; competitiveness studies; expert hearings etc.

In the context of analysis we would like to present the comparison of options and assessment of cost-effectiveness. Horizon 2020 emerges as the preferred option. It was also endorsed as the preferred option in the 29th June 2011 Commission Communication on the next Multi-annual Financial Framework 2014-2020. This option has clarity of focus and a well-developed intervention logic. Like the BAU option, it achieves critical mass at the programme and project level. It also enhances the promotion of scientific and technological excellence and allows for more flexibility. Levels of administrative burden would be reduced drastically, significantly improving accessibility and increasing stakeholder support. Knowledge triangle and broader policy coordination are enhanced through a single framework seamlessly integrating research, education and innovation aspects and explicitly defining links with other policies. SMEs would benefit in particular from administrative simplification and closer knowledge triangle coordination particularly concerning research and innovation finance. S&T and innovation impacts would be enhanced through the seamless support from idea to marketable product, stronger output orientation, better dissemination of results, clearer technological objectives, enhanced industrial and SME participation and thus better leverage, the funding of demonstration activities, and innovation financing and support. Enhanced scientific, technological and innovation impacts would translate into larger downstream economic, competiveness and social impacts (see Box 1), as well as environmental and EU policy impacts.

Horizon 2020 also maximises cost-effectiveness. On the cost side, its far-reaching integration, simplification and harmonisation will reduce costs for the Commission and for applicants. At the same time, the Horizon 2020 option maximises the benefits through a close integration of research, innovation, and training. This will provide the best approach for ensuring that investments made at EU level in research projects are fully valourised into patents and new products, processes, and services.

Quantifying economic, competitiveness and social impacts

The enhanced scientific, technological and innovation impacts produced by Horizon 2020 should translate into larger downstream economic and competitiveness impacts. It is estimated that by 2030 it could generate the following impacts over and above the BAU option:

- Horizon 2020 will stimulate Europe's economic growth, generating 0.53 percent of extra GDP.
- It will also enhance Europe's competitiveness, increasing its exports by 0.79 percent, and reducing its imports by 0.1 percent.
- It will create jobs for Europe's citizens, increasing employment by 0.21 percent.

Under the renationalisation and discontinuation options, the effects would be weaker compared with the BAU option by 2030:

- Renationalisation would reduce GDP by 0.04 percent, cut 0.06 percent off exports, have no effect for imports, but would lead to a job loss of 0.01 percent.
- Discontinuation would shave 0.39 percent off GDP, decrease exports by 0.58 percent, and raise imports by 0.05 percent, while producing job losses of 0.19 percent.

Comparing the positive effects of the Horizon 2020 option with the negative effects of the discontinuation option demonstrates its true added value:

- By 2030, it is expected to generate an extra 0.92 percent (0.53+0.39) of GDP, 1.37 percent (0.79+0.58) of exports, -0.15 percent (0.10+0.05) of imports, and 0.40 (0.21+0.19) percent of employment.

Box 1. Quantifying the economic, competitiveness and social impacts

Source: (SEC 1428 final 2011).

The BAU+ option would allow for some alignment of objectives and achieve a certain degree of simplification producing positive effects on administrative burden, accessibility, reach, structuring effects, leverage effects, innovation impacts and downstream economic, social, environmental and EU policy impacts. In the case of the renationalisation option, it would be more difficult to orientate Europe's research and innovation programmes on commonly agreed objectives while critical mass and excellence would be compromised. The quality of the intervention logic, the level of flexibility, accessibility and reach, and the extent of knowledge triangle and broader horizontal policy coordination could in theory be enhanced more easily at the national or regional level, though this is not the case now, and would involve important trade-offs. This would compromise the return on investment in research as scientific, technological, and innovation impacts would be reduced, which would translate into smaller economic and competitiveness, social, environmental, and EU policy impacts. A summary of the comparison of options is given in Table 4.

Table 4. Impacts of the BAU+, Horizon 2020, and renationalisation options compared to the BAU option

Dimension	BAU+	Horizon 2020	Renationalisa-tion
EFFECTIVENESS			
Focus	+	++	+(1)
Intervention logic	=	+	+/-(2)
Accessibility, reach	+	++	++(4)
SMEs	+	++	++(5)
Excellence	=	+	-
Critical mass	=	=	-
Structuring effect	+	++	-
Leverage effect	+	++	-
Innovation impact	+	++	-
Economic and competitiveness impact	+	++	-
Social impact	+	++	-
Environmental impact	+	++	-
Impact on EU policy	+	++	-
EFFICIENCY			
Reduction of administrative cost	+	++	++(3)
Reduction of participation cost	+	++	++(3)
COHERENCE			
Knowledge triangle coordination	+	++	+/-(2)
Broader horizontal policy coordination	=	+	+/-(2)
Flexibility	=	+	++(3)

Notes: (1) Easier to focus programmes, but more difficult to focus them on pan-European objectives; (2) In theory, easier to achieve/enhance; in practice, mixed Member State and regional performance; (3) but reduced critical mass, excellence; (4) but reduced critical mass and ability to pool resources; (5) but reduced access to foreign partners, capabilities, markets.

Source: (SEC 1428 final 2011).

Under Horizon 2020, only those kinds of activities will be supported that have passed the European added value test. Under the proposal on the next MFF, the funding for Horizon 2020 amounts to €80 billion (constant 2011 prices), which represents a 46 percent increase with respect to comparable funding under the MFF 2007–2013 (constant 2011 prices). The new system for the evaluation and monitoring of Horizon 2020 will be based on a comprehensive, well-timed, and harmonised strategy, with a strong focus on throughput, output, results and impacts.(SEC 1428 final 2011)

Conclusion

In the second decade of the 21st century and especially in the new budget perspective 2014–2020 on the backdrop of a changing world order, the European Union faces a series of crucial challenges: low growth, insufficient innovation, and a diverse set of environmental and social challenges. Europe 2020, the EU's comprehensive long-term strategy, recognises these challenges and argues that Europe faces a moment of transformation. The solutions to all of these problems are linked. It is precisely by addressing its environmental and social challenges that the European Union will be able to boost productivity, generate long-term growth, and secure its place in the new world order.

It must be emphasised that structural reforms are necessary to facilitate adjustment and improve the framework conditions for European Union growth. Structural reforms, which improve competitiveness, wage responsiveness and price flexibility are key to improving adjustment capabilities and to stimulating the transfer of resources from declining to growing sectors. Reforms promoting job creation, investment in innovation, skills and inclusive growth are necessary to tackle the risk of hysteresis and alleviate the negative impact of the crisis on social conditions. A fair distribution of the adjustment burden across society is important for sustained growth. Ultimately, however, a coherent policy mix encompassing both macro-financial and structural policies is indispensable for growth to resume. Hence a determined policy action on all these fronts is necessary to counter the negative dynamics and improve the economic situation in a sustainable manner.

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