Quality of jobs and innovation generated employment outcomes

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INNOVATION AS AN ENGINE FOR INCLUSIVE GROWTH: SIGNIFICANT CHALLENGES FOR POLICY LEARNING ON THE EVE OF DIGITALISATION

QuInnE Working Paper No. 12

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July, 2018

WP4-D4.3

QuInnE - *Quality of jobs and Innovation generated Employment outcomes* -is an interdisciplinary project investigating how job quality and innovation mutually impact each other, and the effects this has on job creation and the quality of these job.

The project will run from April 2015 through July 2018. The QuInnE project is financed by the European Commission's Horizon 2020 Programme 'EURO-2-2014 - The European growth agenda', project reference number: 649497.

Quinne project brings together a multidisciplinary team of experts from nine partner institutions across seven European countries.

Project partners:

CEPREMAP (Centre Pour la Recherche Economique et ses Applications), France

Institute of Sociology of the Hungarian Academy of Sciences, Hungary

Lund University, Sweden

Malmö University, Sweden

University of Amsterdam, The Netherlands

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Introduction

A key research question of the QuInnE project is to map and assess the interrelationship between innovation, employment and job quality. As part of this work, the research consortium aimed to systematically review innovation policies at both EU and national levels. By doings so, we intended to better understand which policies and modes of implementation produce positive innovation effects, especially in relation to job quality and employment under various national contexts. We also paid special attention to the question of inclusiveness, more precisely to the question to what extent are the benefits of innovation promote an inclusive society. According to Schmid, there are quantitative and qualitative dimensions of inclusive employment growth. The first covers to the employment and unemployment rates, in particular for some especially vulnerable groups (youth, elderly, women, people with disabilities, etc.). Qualitative dimension of inclusive growth includes working and employment conditions, as well as other aspects of job quality, labour market insecurity and social protection. (Schmid, 2018:4) This definition fits particularly well to the theoretical framework of the QuInnE project because it takes into consideration both (quantitative) macroeconomic and (qualitative) firm-level evidences, has a special focus on vulnerable social groups, and pays particular attention to transitional labour markets through the application of the 4S jobs model (Warhurst et al. 2016).

This paper synthesises what has been found so far and builds strongly on previous deliverables. The first one[1] aimed to assess the most recent innovation policy trends in the countries represented in the project, namely in France, Germany, Hungary, the Netherlands, Spain, Sweden and the UK. The second working paper[2] summarised the evolution of the European Union's innovation policy. Beside these, some sort of meta-analysis has also been carried out overviewing the evolution of the theoretical and methodological framework of the innovation policy evaluation itself.

In this paper we will only focus on the most important findings that are relevant for stakeholders involved in the innovation policy formation process at both European, national or regional level. First, we will briefly outline the evolution of innovation theory and innovation policy and the significant epistemological gap between the two. Second, we give an overview on the evolution of EU innovation policies as these policies have been playing a lighthouse role for two decades from now, orientating the direction of policy formation of Member States at national level. Third, we briefly outline the most important empirical findings of the quantitative and qualitative work packages of the QuInnE project that are relevant from an innovation policy perspective. Fourth, we will summarise the most important lessons learned during this exercise.

[1] Makó–Illéssy, 2015
[2] Makó–Illéssy–Warhurst, 2016

I. Theoretical and methodological framework of innovation policy evaluation

As Fagerberg (2014) rightly observed the definition of innovation policy depends on the theoretical foundations of innovation. This means that all choices policy makers take in elaborating innovation policies have their more or less direct theoretical implications. In order to understand innovation policies in Europe at different (European, national or regional) levels we have to understand the theoretical choices and assumptions that are implicitly or explicitly made. The roots of innovation studies can be found at science policy research (Martin, 2015) and this root deeply influences the theoretical and methodological framework of not only innovation studies but innovation policies as well. As Martin noted, the science policy research was born in the late 1950s and since then significant shifts have been made in both the research and policy focus of innovation. However, as we will later point out the speed of these shifts are different in the two cases (innovation studies vs. innovation policies), the former being significantly outpaced the latter.

The mere notion of innovation is often loosely defined; there is no scientific consensus about what innovation is and what is not, that is from what point of novelty we can speak about 'real' innovation, what are the differences between different types of innovation (e.g. product, process, organisational and marketing but the same is true for the dichotomy of radical and incremental innovation) especially as they are intertwined in most of the case. It is obvious that this lack of clarity concerning the definition does not facilitate the elaboration of adequate innovation policies and that often unconscious theoretical choices of policy makers have a deep impact on how states try to encourage innovation activity of the society and on how effectively they are doing so. This is even more important as despite the fast growing literature of innovation studies still the traditional view dominates the public discourse. On the basis of the abovementioned recent work of Fagerberg, we can sketch two stylized approaches to innovation and thus the innovation policies.

In the more traditional narrow approach innovation is regarded as a linear process, where the source of all innovation activity is scientific research. The results of the scientific basic research are in turn transformed into engineering and manufacturing, while the new product is sold through marketing and sales activities. The directions in the process are unilateral, there are no feedback mechanisms in this system. An implicit consequence of this approach is that innovation is mainly regarded as something primarily producing radically new products or processes, incremental innovations are seen as of secondary importance. It is also worth noting that the narrow approach puts particular emphasis on the emergence of new ideas, while their wider exploitation and diffusion remains a relatively neglected aspect of innovation. In the narrow approach, innovation is something very technological and thus the primary location where it occurs is the manufacturing sector. This approach also puts special emphasis on the generation of explicit knowledge. Policies therefore aim to improve both the quantitative and the qualitative aspects of the higher education system (e.g. by raising the number of PhD students) and the research base of the country.

All these characteristics of the narrow approach denote the main rationale of state intervention in the field of innovation. It is embedded in the neo-classical stream of the economic literature

in which self-regulated markets would create the optimal resource allocation. According to this argument, innovation has 'public good' properties inhibiting firms to invest as much in innovation as the 'optimum level' would require. This is the so-called market failure argument (Fagerberg, 2014, p. 5.). Schienstock and Hamalainen (2001) gave an essential critic of the narrow (traditional) approach by underlining its following implicit assumptions: innovation is understood in the narrow approach as an exceptional event; innovation and the process of knowledge creation is seen as an isolated process; problems of uncertainty remain unsolved; R&D is supposed to be the main (if not the only) source of innovation; and the narrow approach also neglects collaborative elements of innovation (Schienstock and Hamalainen, 2001, p. 50.).

There is increasing volume of evidence in the research community that suggests that the linear model of innovation represents rather the exception than the rule (Edquist, 2014). Most of the times it is hard to find any direct casual link between new scientific knowledge and innovation. Schienstock and Hamalainen (2001) as well as Alasoini (2015) contrast the activity-based understanding of innovation to the science-based notion of innovation which can take place anytime and anywhere. Instead of being a single event, innovation should be rather seen as a continuous process related to everyday practices in the organisation. Thus they stress the importance of incremental innovations. Another basic feature of innovation concerns its ambiguous and uncertain character. In order to cope with this inherent uncertainty, they propose using the recursive model of innovation as opposed to the linear one: 'Because of this uncertainty, we cannot identify clear sequences of stages in innovation processes; instead, we have to analyse innovation as a recursive process, in which particular innovation activities can become both cause and effect, consequence and prerequisite' (Schienstock and Hamalainen, 2001, p. 51.) In this model the triggers of innovation may vary depending of the given case, there are multiple actors involved in the process of innovation and there are 'complicated feedback mechanisms and interactive relationships' among them.

As this model stresses the importance of the socially embedded character of innovation, it is implied that instead of explicit knowledge, the tacit dimension of knowledge will be more relevant, with trust relations and collective knowledge playing a key role (Lundvall, 2009). Similarly Jensen et al. (2004) analysed the interrelationships between innovation activities and their knowledge base. They distinguished four types of knowledge and two main modes of innovation activities. The four types of knowledge are 'know what', 'know why', 'know who' and 'know how'. The former two types ('know what' and 'know why') refer mainly to explicit scientific knowledge, whilst the latter two ('know who' and 'know how') which are something closer to tacit knowledge: competence or (social skills). These types of knowledge are complementary, in most of the cases all of them are used during the process of innovation. However, they involve different types of learning processes and thus require different types of knowledge management systems (KMS).

The authors distinguish two types of KMS: the STI-mode and the DUI-mode. As concerning the former: 'The STI-mode of knowledge management and learning (Science, Technology, Innovation) implies that codified knowledge, and scientifically based ways of getting access to, producing and utilizing it are dominating the process of innovation. The STI mode most obviously depends on explicit know-why though, as we have argued, skills and interpretative frames also play a role' (Jensen et al., 2004, p. 14.). In contrast: 'The DUI-mode of learning

and innovation (Doing, Using, Interacting) most obviously relies on know-how, which is tacit and often highly localized. This mode involves building structures and relationships, which enhance and utilize learning by doing, using and interacting. (…) The DUI mode of learning is characterised by on-going changes that continuously confront employees with new problems. Finding solutions to these problems enhances the skills of the employees and extend their repertoires. Some of the problems are specific while others are generic ' (Jensen et al., 2004, p. 15-16.).[3]

The recursive model of innovation implies different policy making strategy compared to the linear model of the narrow approach. This is mainly because the interactive and collective character of innovation, much emphasised in the recursive model, has to be taken into account. Trust relations, strong cooperation and intensive social interactions between the actors involved ensure the necessary flow of information and shape continuously the learning processes playing a central role in this model (Schienstock&Hamalainen, 2001 and Alasoini, 2015). This different approach in policy making is best reflected by the theoretical stream of national innovation systems. In this view each country represents a specific case with specific actors and institutions and with unique relationships among them. National systems of innovation evolve historically and show path-dependent character, i.e. resisting capacity towards the changes in the environment. It is also implied that there are no universal policy solutions or instruments that can be effectively implemented independently from the concrete context of the given country.

In the innovation research literature, innovation system approach (be it either national, regional, or sectoral, etc.) became soon the dominant scientifically accepted view. There is a plethora of definition on what constitutes an innovation system. According to Lundvall, an innovation system consists of "… all parts and aspects of the economic structure and the institutional set up affecting learning as well as searching and exploring – the production system, marketing system, the system of finance present themselves as subsystems in which learning takes place" (Lundvall, 1992:12) Beside this very broad definition, the concrete elements of an innovation system may vary from country to country depending on the historically evolved institutions and actors on the one hand, and on the specific research questions and the theoretical assumptions in which these research questions are embedded.

The following table summarises the main theoretical assumptions of the two stylized approaches of innovation.

[33] Lundvall (2008) demonstrated that this distinction is not new at all and some its elements can be traced back to Adam Smith (Lundvall, 2008, p. 22-23.).

Table 1: The evolution of innovation theory: from narrow to broad-based concept of innovation

Dimensions	Narrow Approach	Broad Approach
Model of innovation	Linear	Recursive
Dominant form of innovation	Radical	Incremental
	Technological	Non-technological
Knowledge base	Scientific, explicit and individual	Practical, tacit and collective
Mode of innovation	STI-mode	DUI-mode
Dominant sector	Manufacturing	No focus on specific sectors
Rationale for state intervention	Market failure approach	System approach & Entrepreneurial state

Source: own compilation

The differences in the theoretical assumptions of the two stylised approaches of innovation have their consequences in terms of innovation policy outcomes and effects. It is not at all surprising, though worth noting, that a policy based on the broad approach of innovation may have more encompassing effects in the wider segments of the economy and the society, while the direct effects of a policy based on the narrow approach of innovation are limited to the R&D- and manufacturing-related spheres of the economy. Furthermore, as we will see from the following sections, the interrelationship between innovation, job quality and employment can appear as in important dimension of innovation policy mostly in the case of systemic or broad-based innovation policy. In the following section, we will shortly evaluate evolution of European innovation policies, then we will have a closer look on the QuInnE-countries, that is on France, Germany, Hungary, the Netherlands, Spain, Sweden and the UK.

2. The evolution of the concept of innovation in European innovation policies

This section describes and evaluates how the concept of innovation has changed across different European Commission (EC) policy documents over the past 15-20 years. The examination of the content of these documents draws on the theoretical framework summarised in the previous section. It should be noted he EC has produced a large number of innovation policy documents over this time and a meta-analysis of these documents is beyond the scope of this working paper. Instead, prefaced by the 1995 Green Paper on Innovation, the paper examines the most important innovation policy documents related to the two key ten-year strategies of the EC, namely the Lisbon Strategy and Horizon 2020.

2.1 Green Paper on Innovation (1995)

One of the very first documents aimed at determining innovation policy at the European level was the *Green Paper on Innovation* adopted in 1995 (EC 1995). The objective of the Green Paper was to identify key factors and policy measures through which innovation activity could

be enhanced in the EU. Although the definition of innovation adopted in this strategic document was quite vague – 'the successful production, assimilation and exploitation of novelty in the economic and social spheres' (EC 1995: 1) – the document does later include definitions for product, process and organisational innovation. The document also emphasized the role of the public sector and the importance of innovation culture generally as well as an appreciation of firm-level practice and capabilities, as the document puts it 'innovation is … the introduction of changes in management, work organisation, and the working conditions and skills of the workforce' (p.1).

In relation to the theoretical framework briefly sketched in the previous section, the Green Paper vacillates between the broad and narrow approaches to innovation. The document recognizes that innovation is not a linear process but involves dense interactions of different actors. Reflecting the broad approach the Green Paper states that innovation

> … is not a linear process, with clearly-delimited sequences and automatic follow-on, but rather a system of interactions, of comings and goings between different functions and different players whose experience, knowledge and know-how are mutually reinforcing and cumulative. This is why more and more importance is attached in practice to mechanisms for interaction within the firm (collaboration between the different units and participation of employees in organisational innovation), as well as to the networks linking the firm to its environment (other firms, support services, centres of expertise, research laboratories, etc.). Relations with the users, taking account of demand expressed, and anticipating the needs of the market and society are just as important – if not more so – than a mastery of the technology. (EC 1995: 1)

The Green Paper also distinguishes between radical and incremental innovation, giving equal importance to both kinds of innovation. The document also argues that organisational innovation plays a crucial role in being a necessary precondition for the success of other forms of innovation and that Europe lags behind its competitors in this field. As to which sectors are innovation-centred, the document also remains neutral, recognizing the importance of innovation not only in high-tech sectors but also in agriculture, services and even the public sector.

Despite this rhetoric, there is a noticeable gap between the theoretical orientation of the Green Paper and the measures proposed; whilst the former reflects the broad approach to innovation, the latter are grounded in the narrow approach of innovation. In this respect, the document refers to one of the most important weaknesses faced by the EU being the so-called 'European paradox'. This term refers to the fact that while Europe performs well in terms of basic scientific research it struggles to transform its scientific excellence into commercial success compared to its main competitors: at that time the US and Japan.[4] This analysis had a long-lasting impact on the orientation of European innovation policies, focusing mainly on patent regulation, tax incentives and stronger collaboration between R&D sectors and industry, strengthening the technology absorption capacity of SMEs etc. Although from an innovation theoretical point of view, this document can be evaluated as one which fully applies the broad approach, in terms of policy measures it remains technology-oriented. In the second part of the paper, the

[4] The question to what extent this statement was true at that time is not investigated in this Working Paper. However, note that according to the Green Paper by 1993 there already existed a significant gap between the US, Japan and the EU in R&D expenditure as a share of GDP (2.7%, 2.8% and 2.0% respectively) and the gap was widening.

Commission proposes a full set of actions that has to be taken in order to improve innovation capacity of both firms and individuals in the European Union. None of the 13 measures[5] listed link to non-technological innovation but instead reflect a narrow approach especially emphasizing the importance of technological innovation, scientific, explicit and individual knowledge-base, the STI mode of innovation and the manufacturing sector. This dissonance between theoretical grounding and the focus on particular measures is a pattern that can be identified in subsequent EU innovation policy.

In terms of the relationship between innovation and the quantitative and qualitative aspects of employment, the Green Paper emphasizes mainly the former. It is argued that product innovation boosts employment by increasing demand and thus investment. Process innovations, for their part, also increase employment because it increases firm productivity or lowers production costs. As such, in the long term, a positive effect on employment growth may occur. However, the relationship between innovation and job quality is poorly developed in the document. There is appreciation that 'by its nature innovation is a collective process which needs the gradual commitment of an increasing number of partners. In this respect, the motivation and participation of employees is critical for its success' (p.11). However the document also warns of a trade-off between the quantity and quality of jobs, whilst 'innovation generally improves living and working conditions, care has to be taken that new methods of organising work (such as just-in-time working) do not jeopardise jobs.' (p.11).

2.2 First phase of Lisbon Strategy and the changes in the innovation concept (2000-2004)

The aim of the Lisbon Strategy (2000) was to create a knowledge-based economy and society as the basis for the EU becoming the most competitive and dynamic economy in the world[6]. The Strategy defined three strategic goals: sustainable economic growth; more and better jobs; and greater social cohesion. It was not at all surprising that in the context of knowledge-based economy, innovation quickly became a core issue. There were two main initiatives intended to foster innovation. The first was the establishment of the European Area of Research and Innovation; the second was to create innovation-friendly environments for start-ups and SMEs.

The European Research Area (ERA) is a tool to coordinate research activities at the national and European level in order to support Europe's best researchers and scientists. This aim could be achieved, argued the Strategy by – among other things – developing joint research programmes, creating an environment that stimulates to increase of private investments in R&D, benchmarking national R&D policies, establishing the European Innovation Scoreboard, fostering the mobility of European researchers and creating a common European patent protection.

The second initiative aimed to increase the competitiveness and dynamism of the business sector by creating a friendlier environment especially for start-ups and SMEs. To do so involved lowering the costs and the administrative burdens of doing business. Encouraging interfaces

[5] The Green Paper defines 13 Route of actions as follows: Develop technology monitoring and foresight, Better direct research efforts towards innovation, Develop initial and further training, Further the mobility of students and researchers, Promote recognition of the benefits of innovation, Improve the financing of innovation, Set-up fiscal régime beneficial to innovation, Promoting intellectual and industrial property, Simplify administrative procedures, A favourable legal and regulatory framework, Develop 'economic intelligence' actions, Encourage innovation in enterprises, especially SMEs, and strengthen the regional dimension of innovation, Update public action for innovation.

[6] The Lisbon Strategy is available:
http://www.consilium.europa.eu/en/uedocs/cms_data/docs/pressdata/en/ec/00100-r1.en0.htm

between the partners of the Triple Helix models and advisory services and other types of business angels also became a priority. In support of this initiative the European Investment Bank launched its *Innovation 2000 Initiative*[7] covering five main areas: human capital formation; research and development; information and communications technology networks; diffusion of innovation; development of SMEs and entrepreneurship.

As these two initiatives reveal, there is scant attention in these key policy documents to the broad approach to innovation. In fact, the only quantifiable innovation related objective of the Strategy was to increase the share of R&D expenditures in the GDP from 1.9% to 3% by 2010 and to raise the proportion of private sector generated GDP from 55% up to 67% of the total. According to the document's estimations, such growth would lever an additional 0.5% GDP growth and 400,000 additional jobs per year after 2010.[8] However, to do so would have required an annual growth rate of 6% for the public sector and 9% for the private sector – figures that were never realised. It should also be said that although innovation is recognised as playing a crucial role in achieving another strategic objective – increasing the European employment rate from 61% to 70% – its impact on job quality was not explored in any detail despite the policy desire to create better, not just more, jobs.

The implementation of the Lisbon Strategy was achieved in three main phases. This first period, known as Lisbon I, occurred between 2000 and 2004. This phase was followed by a mid-term review and a second phase of the Strategy over 2005 to 2008, known as Lisbon II. This mid-term review resulted in a slightly modified innovation strategy *European Partnership for Growth and Jobs* and in an Action Plan *More Research and Innovation – a Common Approach*. The third phase was the continuation of Lisbon II in the context of global financial crisis and economic downturn.

Before the mid-term review, the European Commission also issued a communication updating the concept of innovation[9] and also had an action plan.[10] Both documents were approved in 2003. The former document represents a theoretical shift from linear to a systemic model of innovation:

> Important though research is as the source of invention, innovation encompasses more than the successful application of research results. The evolution of the innovation concept – from the linear model having R&D as the starting point to the systemic model in which innovation arises from complex interactions between individuals, organisations and their operating environment – demonstrates that innovation policies must extend their focus beyond the link with research. (EC 2003a: 4)

In addition to the R&D-based linear approach, the document also recognises the importance of incremental innovations, value-innovation[11], organisational and business model innovation, and design and marketing innovation. Interestingly, the document criticized previous innovation policies: 'Although it is the systemic model that now dominates in policy discussions, many measures put into practice with the intention to promote innovation still appear to owe more to the linear view' it admitted (EC, 2003a:7) – whilst maintaining the strategic aim of raising R&D expenditure to 3% of GDP.

[7] See in detail: http://cordis.europa.eu/finance/src/inno2000.htm
[8] European Commission, 2003(b).
[9] EC (2003a).
[10] EC (2003b).
[11] This notion was popular at the end of the 1990s and refers to innovation as the main driving force in the search for new markets, and can occur via radical as well as incremental innovation.

This broadening of the approach to innovation involved not just a shift in the focus of innovation policy but also recognition that enterprises are at the heart of innovation. As such the most important target of innovation policy should be enterprises, their behaviour, capacities and environment. In parallel with this shift, statistical data analysis was also to be reviewed: 'These models also colour measurements of the innovation process and innovation performance, which are usually biased towards indicators of technological innovation.' (EC 2003a: 7)

While the policy upgrading document explored the new broad-based approach of innovation, the action plan that came later in the same year reflected less of elements from the renewed concept of innovation elaborated a few months earlier. The only focus of the action plan was to design policy initiatives to help to reach the Barcelona objective – that is, to increase the average research investment level from 1.9% of GDP to 3% of GDP by 2010 and of which two-thirds should come from the private sector.[12] Although the plan notes in footnote 8 that: 'Technological innovation must often be combined with other forms of innovation, such as in design, marketing and business organisation, in order to draw the full commercial benefit.' (EC, 2003b:7), initiatives aimed to boost organisational or other non-technological innovation are absent from the action plan.

Whilst both the policy document (EC 2003a) and the action plan (EC 2003b) emphasize the important role that innovation plays in boosting employment, the quality of this employment was not taken into consideration in either text. This absence is not surprising given that among the structural indicators intended to continuously monitor the success of the implementation process of the Lisbon Strategy and approved by the European Council in March 2000 none are aimed at measuring non-technological innovation or issues related to job quality (beside life-long learning[13] and accidents at work). Instead the indicators and focus on employment rates (including that of older workers), unemployment rates, the gender pay gap and the tax rate on low-wage earners; the innovation and research section included indicators such as public expenditure on education, total R&D expenditure, the level of Internet access, the number of science, technology, engineering and mathematics (STEM) graduates, patenting activities, venture capital investments and ICT expenditure. In other words, reflecting the narrow approach to innovation. Although it was planned from 2000 to develop indicators measuring job quality, that intention was never realised. They are still missing from the headline indicators accompanying the Europe 2020 strategy which retained two rough indicators: the employment rate of those aged between 20-64 years of age (the target being 3% by 2020) and the gross domestic expenditure on R&D (the target is 3% by 2020).

2.3 Mid-term review and the second phase of the Lisbon Strategy (2005-2008)

The first phase of the Lisbon process ended in 2004 and was followed by a mid-term review. The strategic objectives of the Lisbon Strategy had not been achieved: the gap in competitiveness had widened compared to North America and Asia; the employment rate of the EU-15 countries did not rise to 65% and the share of R&D expenditure was 1.83% of the EU-15 GDP according to Eurostat. Nevertheless, the mid-term review led by a High-Level Expert Group headed by Wim Kok (EC, 2004) did not rewrite the Strategy's objectives; instead it proposed a narrowing of their focus and urged more effective implementation through better governance and mobilisation. As one of the key documents evaluating the Lisbon Strategy noted:

[12] This objective was officially by the European Council in meeting held in Barcelona on March 2002.
[13] Life-long learning refers to the adult participation in education and training.

> … the conclusions of the mid-term review were very critical, especially as regards the design of the Strategy: an overly ambitious agenda; excessively numerous and often contradictory priorities; poor coordination of policies in different areas; and a limited sense of urgency and commitment at national political level. It also subscribed to the idea of limiting the number of objectives and targets, focusing on 'growth and jobs' and placing concrete measures ahead of the strictly quantified targets for 2010. (European Parliament 2010:38)

Innovation remained a core issue in the renewed agenda as an engine for both growth and employment. The mid-term review did not result in any significant changes in innovation policy. After reviewing the Lisbon Strategy, the Commission issued several important communications. The first (EC 2005a: Working together for growth and jobs – A new start for the Lisbon Strategy) is a general reorientation of the Strategy based on the Wim Kok Report. The second (EC 2005b: More Research and Innovation – Investing for Growth and Employment: A Common Approach) is a more specific policy guideline about the next steps needed in the field of research and innovation. Both of these documents are derived from Integrated Guidelines. Based on the Wim Kok Report (EC 2004) the Commission summarized the main objectives of the renewed Lisbon Strategy into the Integrated Guidelines for Growth and Jobs, 2005-2008 (EC 2005c). These Integrated Guidelines were divided into two parts, the first dealt with broad economic policy; the second with employment. The first includes a special section on how to boost innovation. Among the 23 guidelines, four are dedicated to measures related to innovation (p. 21-23.).[14]

The second part of the Integrated Guidelines, the Employment Guidelines, included quantitative employment targets: an average overall employment rate of 70%, with employment rates of at least 60% for women and of 50% for older workers (55-64 years). In addition, the guidelines offered some general recommendations to promote the quality of jobs. However, no reference was made to the interrelationships between innovation, and qualitative and quantitative aspects of employment; the two issues appear almost completely separate. The Guidelines aim to exploit synergies between quality at work, productivity and employment and to improve quality of jobs, including pay and benefits, working conditions, job security, access to lifelong learning and career prospects, but it remains rather broad and innovation only intervenes through labour productivity.

The communication *More Research and Innovation – A common approach* contained concrete policy measures through which the Commission intended to 'put research and innovation at the heart of EU policies' (EC, 2005b:5). The majority of these measures were related, however, to research, science and technology rather than innovative enterprises. For example, it aimed to create: a better regulatory framework for new technology, a more effective and efficient protection of IPR, an attractive single market for researchers, a better designed and more widely used system of tax incentives, and to use public procurement to foster research and innovation and make European Structural Funds as well as the Community Framework for State Aid for R&D more research and innovation oriented.

There are, however, some new elements in this innovation policy document. First, it makes explicit reference to market failure approach as a rationale for state or EC-level intervention, making it easier for Member States to better target the aid to … market failures' (EC 2006:4). Suggested intervention include R&D projects, technical feasibility studies, industrial property

[14] Guideline No. 12. To increase and improve investment in R&D; Guideline No. 13. To facilitate innovation and the take up of ICT; Guideline No. 14. To encourage the sustainable use of resources and strengthen the synergies between environmental protection and growth; Guideline No. 15. To contribute to a strong industrial base

rights for SMEs, innovation advisory services and innovation support services, aid for young innovative enterprise and or aid for innovative clusters. This inclusion contrasts sharply with the argument of previous policy documents in which system approach was adopted. Another new element is the inclusion of a stronger sectoral focus. The document admits that different sectors have different sectoral needs and specificities which have to be taken into consideration if innovation policy is to improve competitiveness. In relation to this sector-focused reorientation, a separate strategy exists aimed to promote innovative services in the EU and intervention to boost for process and organisational innovation in services is encouraged. The reason for targeting services is a belief that 'Innovation in services … is typically less systematic' and that services tend to 'adopt [] of business and organisational models and practices from more innovative sectors' (EC 2006: 16-17).

A slight shift can be detected towards non-technological innovation: in its introduction the Communication 'addresses the full research and innovation spectrum, including non-technological innovation' (EC 2005b: 7). The document still echoes the important objective of having more and better jobs but no explicit reference is made on the relationship between innovation and job quality.

2.4 Crisis and the third phase (2008-2010)

The last phase of the Lisbon Strategy was dominated by the global financial crisis and economic downturn. The European Commission responded by launching the *European Economic Recovery Plan* (EC 2008). The aim of the Plan was twofold: first to safeguard the purchasing power of the people in order to maintain demand; and, second, to direct short-term actions in selected areas with the aim of maintaining Europe's future competitiveness. The Commission determined four priority areas: people, business, infrastructure and energy, and research and innovation. This latter area included three main fields of actions:

1. Increase investment in R&D, innovation and education.
2. Develop clean technologies for cars and construction.
3. High-speed internet for all.

The second type of actions included 'smart' investments, combining innovation and the green economy, and maintaining the competitiveness of some key European industries (i.e. car manufacturing and constructions). As such, the plan was consistent with the existing priorities of the Lisbon Strategy.

2.5 Horizon 2020 and its first evaluation

In the new European strategy, Horizon 2020, innovation remains an important issue and is one of seven flagship initiatives. The aim is to adopt a more strategic approach to innovation so that is becomes an 'overarching policy objective' (EC 2010a: 2). The *Innovation Union* is built around 34 specific commitments in five main thematic areas: strengthening the knowledge base and reducing fragmentation; getting good ideas to market; maximising social and territorial cohesion; pooling forces to achieve breakthroughs: European Innovation Partnerships; leveraging policies externally.

Overall, the strategy aims to link better research and innovation to each other in order to get out more value from investments in research into innovation. Of the 34 commitments, some are more pertinent to this Working Paper. Again, and despite the financial and economic crisis, one

of the primary aims of the strategy remains increasing R&D&I investments to 3% as a share of GDP in all Member States[15]. The strategy argues that investments in education, R&D&I, innovation and ICTs should be protected from budget cuts. The strategy not only aims to increase the amount of investment in R&D&I but also wants to use this money in a more effective way by tackling fragmentation in research and innovation systems at EU and national levels. Modernisation of the education system includes the creation of more world-class universities and the attracting of top talent from abroad. The European Research Area also needs to be strengthened to promote the cross-border cooperation of European researchers and innovators, and to ensure a free movement of knowledge. The EU also wants to simplify its own R&D&I programmes, ensure that access to them is open to everyone in an equal way. The leverage effect of public spending on private sector investments also has to be enhanced, the document argues. Public procurements also have to be used in a more strategic way promoting innovation activities of the enterprises. Obstacles to bringing ideas to market have to be removed. Fast growing SMEs in particular are targets for the easing of access to finance and making intellectual property rights more affordable to enterprises.

In terms of its theoretical positioning, the new European innovation strategy represents a significant shift from the narrow to the broad approach to innovation. However that shift appears to leave policy somewhere halfway between the two. In this respect it is important to note the launch of other contemporaneous EU initiatives such as the Commission's *Employment and social development in Europe 2014* publication. Chapter 3 of this document deals with the future of work in Europe, and makes explicit the importance of 'job quality and work organisation for a smart and inclusive growth'. In this respect, the DG GROW (the former DG ENTR) of the European Commission is supporting the diffusion of workplace innovation by creating the European Workplace Innovation Network (EUWIN) in 2013 with a remit to 'to facilitate the exchange of good practices and promote workplace innovation (Pot 2015).

It is also worth noting that since the beginning of the launch Innovation Union (EC 2010), important policy priorities have been (re)defined. In addition to workplace innovation[16], the six priority areas include: social innovation[17], design-driven innovation[18], demand-side innovation policies[19], public sector innovation[20] and public procurement of innovation[21]. All six priorities have their own policy background paper, action plans and other initiatives. Their respective aims are outlined in Table 2 below.

[15] The Lisbon Strategy (2000) already set the same target for 2010.
[16] http://ec.europa.eu/growth/industry/innovation/policy/workplace/index_en.htm
[17] http://ec.europa.eu/growth/industry/innovation/policy/social/index_en.htm
[18] http://ec.europa.eu/growth/industry/innovation/policy/design/index_en.htm
[19] http://ec.europa.eu/growth/industry/innovation/policy/demand-side-policies/index_en.htm
[20] http://ec.europa.eu/growth/industry/innovation/policy/public-sector/index_en.htm
[21] http://ec.europa.eu/growth/industry/innovation/policy/public-procurement/index_en.htm

Table 2: Innovation Policies in the European Union (2013)

Field	Aims
Social innovation	• stimulating social innovation as a source of growth and jobs • promoting and sharing information about social innovation in Europe • supporting social innovation projects through the Social Innovation Competition.
Design for innovation	• to increase the use of design for innovation and growth across Europe; • to raise awareness of how design-driven innovation increases efficiency in public services and drives business growth; • to create capacity and competencies to deliver these policies.
Public sector innovation	• to strengthen innovation in the public sector a key player in the field as as a regulator, service provider, and employer • to build an efficient and productive public sector becoming a strong driver of private sector growth • to reach efficiency gains, better governance, faster delivery, and more citizens' involvement in public sector
Public procurement of innovation	• help foster market uptake of innovative products and services • increase the quality of public services in markets where the public sector is a significant purchaser • support access to markets for businesses, especially small and medium-sized enterprises (SMEs) • help address major societal challenges.
Workplace innovation	• to improve performance and working lives, and encourages creativity of employees through positive organisational changes; • to combine leadership with hands-on, practical knowledge of frontline employees; • to engage all stakeholders in the process of change; • to develop methods and indicators for measuring this type of innovation

Source: http://ec.europa.eu/growth/industry/innovation/policy/index_en.htm

With respect to workplace innovation, the Commission also compiled a report on a methodology for its measurement (EC 2014b). This methodology is important as it can be regarded as a first step to link together job quality and innovation: 'Workplace innovation is considered contributing to European competitiveness: It encompasses practices that enhance employers' workability, resulting in higher productivity and improved employees' job-satisfaction and wellbeing. Workplace innovation, hence, is a cross-cutting policy issue, concerning all types of organisations, be they large firms, SMEs or even public administrations' (EC 2014b:6).

Table 3: The evolution of EU innovation policies 1995-2015

	Green Paper (1995)	Lisbon I (2000-2005)	Lisbon II (2005-2008)	Lisbon III (2008-2010)	Horizon 2020
Elements of broad-based innovation concept	Fully applied broad-based approach	A slight shift from linear towards systemic approach appears only in 2003[22]	Public procurement as a tool to boost innovation	No significant changes compared to Lisbon II	Top 6 priorities: social innovation; design-driven innovation; demand-side innovation policies; public sector innovation; public procurement of innovation; workplace innovation
Elements of narrow innovation concept	In terms of proposed policy measures, it remains technology-oriented: importance of technological innovation, scientific, explicit and individual knowledge-base, the STI mode of innovation	Strategic objective is to raise the share of R&D expenditures in the GDP from 1,9% to 3% by 2010	Focus is on R&D expenditures, green economy, strong industrial base and on innovation-friendly environment, explicit reference to market failure approach	Increase investment in R&D, innovation and education. Develop clean technologies for cars and construction. High-speed internet for all	Innovation statistics remained science and technology-focused
Measurement		Establishment of the European Innovation Scoreboard: no indicators on non-technological innovation and on Job Quality			5 key indicators[23] and the creation of Innovation Union Scoreboard and Summary Innovation Index

[22] Though this shift does not appear in concrete policy measures and action plans and remained mainly rhetoric: 'enterprises are at the heart of the innovation process' (EC, 2003a:5)

23 Contribution of innovative-related trade in manufactured goods to the balance of trade of goods; Share of fast growing and innovative firms in the economy; Percentage of employment in knowledge intensive activities; Patent applications weighted by GDP; Hourly labour productivity.

Sector prioritised	Innovation is important in low-tech sectors, in private and public segments of services	No sectoral focus	Promotes innovation in the services	Green economy, car manufacturing and constructions	Health and social service, green economy, public sector
Interrelation of Innovation and Job Quality	Recognised but poorly developed, more focus put on quantitative dimension of employment	Exclusive focus on quantitative dimension of employment, although improving working conditions becomes a strategic objective	‘Better jobs’ dropped from the agenda		Job quality is of high priority again, though not in direct relation with innovation
Social inclusion	Does not appear				Special emphasis on promoting inclusive character of innovation.

Source: own compilation

3. For an evidence-based innovation policy: some lessons learned from QuInnE

In this section we will briefly sum up the results of both the qualitative and the quantitative work packages. We are doing so with the aim to create a link between empirical fieldwork and the present policy analysis. We'll start with a short overview of the results of the quantitative analysis which will be followed by the outline of some case study experiences.

3.1 QuInnE-experiences from a macro perspective: Relatively stable pattern of innovation, job quality and employment nexus over time

Extensive analysis of quantitative data was carried out in the work package 4 including such European-wide surveys as the European Working Conditions Survey (EWCS) or the European Company Survey (ECS) and different national level employer survey from Germany, France and Spain. The aim of these studies was to investigate the impact of innovation on employment and job quality. Here we won't repeat all results but only those which have some policy relevance. This section is based on Duhatois et al. (2018) and Gallie (2018).

The data analysis revealed that there is a positive association between technological (product and process) innovation and both employment and job quality outcomes. Country level analysis showed that technological innovations is weakly correlated with such dimensions of job quality as wage and work-life balance, whilst it had a significant positive impact especially on intrinsic elements of job quality. The results were less clear-cut for organisational innovation. Organisational innovation seems to have no or negative on job quality. Longitudinal company surveys for France show that organisational innovation has a positive effect on employment, it is negatively associated with wages. In Germany organisational innovation is positively correlated with the expansion of part-time work and with an increased labour market participation of low-paid workers. However, it is important to note that organisational innovation is ambiguously conceived and bluntly measured currently (Warhurst et al., 2018). Attempts to diminish employees' discretion and autonomy in work can be very well categorised as innovation as well as those management initiatives that drive at the opposite direction. It is not at all surprising, then, that the effects of these practices are also controversial.

As concerning the inclusive character of innovation, our colleagues revealed that primarily higher skilled employees benefited from the positive employment outcomes of innovation, reinforcing the 'skill-biased technological change' (SBTC) argument versus the 'routine-biased' (RBTC) one. However, these tendencies proved to be cyclical: labour market participation of low-educated people declined mainly after the economic crisis which was followed by some sort of recovery. All in all, the most inclusive labour markets (in terms of employment rate of low-educated and older workers) were found in those countries where the level of both innovation and job quality were high.

Beside these general patterns, the data analysis showed significant differences between the countries both in terms of prevalence of high quality jobs or innovation activities and the interrelationship between the two. The WP5 team established the following country clusters.

Table 4: Country clusters of innovation and job quality nexus

Country group	Innovation	Job Quality
Nordic countries	High	High
North West countries	Medium/High	Medium/High
Continental countries	Medium/High	Medium/High
Central and Eastern European countries	Low	Low
Southern countries	Low	Low
France	High	Low
Estonia	High	Very low
Spain and Poland	Very low	Low

As we can see from the table, only Nordic countries are able to take a win-win road, combining high level of both innovation and job quality. This is accompanied by the inclusive labour market measured by the participation rate of low-skilled and older workforce. Central and Eastern European countries, together with the Mediterranean cluster take the low road of innovation/job quality nexus, but while the employment is about the European average for most member of the former country group, in Southern Europe this weak performance is further aggravated by a relatively low level of employment rate. Interestingly, high innovation performance is accompanied by a low or very low level of job quality in the case of France and Estonia, while in Spain and Poland the very low level of innovation activity is alarming.

Under a separate work task, the quantitative working group aimed to model the relationship between job quality and innovation in more detail. On the basis of the EWCS 2015, a special index was constructed by using 7 variables measuring three dimensions of job quality that seem to be the most relevant from the point of view of innovation. These three dimensions were as follows: training and learning; task discretion and initiatives; and (subjectively perceived) job security. This so-called Innovation Conducive Job Quality (ICJQ) index was categorised into three broad values: low, medium, high. The data show huge differences between these classes of jobs in terms of innovation: in jobs with low ICJQ index a significantly lower share of employees are involved in the improvement of work organisations compared to jobs characterised with high ICJQ index (14.3% vs. 66.6%). The same is true for employees experiencing process or technological innovation (24% vs. 54.1%).

Country-specific analysis revealed that average ICJQ index is the highest in the Nordic countries, followed by the North West country group (UK and Ireland) and the Continental countries, while the lowest ICJQ ratings were found in the Mediterranean and East European countries. What is interesting is that the global financial crisis and economic downturn affected these country groups differently. From a longitudinal perspective, the average score of ICJQ index grew during the crisis (i.e. between 2005 and 2010) in the Mediterranean and Central East European countries (South East countries experienced a significant decline in this regard), while the average score grew after 2010 in the case of North West and Continental country groups. Overall, the differences between country groups decreased between 2005 and 2015 showing some kind of convergence between the Member States of the EU. As concerning the inclusive character of ICJQ index, that is the difference in the average scores by occupational groups, there are significant country group differences, the Nordic countries showing the lowest class gap, while it was the highest in Nord East countries. This gap was widening during the crisis, while it has been reduced during the subsequent recovery period.

Overall, the results of this analysis confirm the hypothesis that there is a positive correlation between certain aspects of good job quality and innovation. However, there are significant differences between the countries investigated. And not only country group differences are noteworthy, but within country inequalities (between occupational classes) are also worrying as they remain relatively stable over time and we have no reason to believe that they will automatically disappear or even decrease. A first important lesson is therefore, that specific policy efforts are needed in this field, most obviously at country-level. It is telling that the high road of innovation-job quality nexus exists only in the Nordic countries in which there exists an inclusive labour market and where these topics have been on the top of the political agenda for decades. The analysis also revealed that the search for short-term flexibility may underpin long-term productivity and competitiveness by negatively affecting innovative initiatives from the part of employees.

3.2 There is no deterministic nexus between innovation, job quality and employment: lessons learnt from the company case studies

If the results of the quantitative work package was summarised in an extremely brief way, this is even more the case for the qualitative work package. In total 59 company case studies were conducted in 8 sectors: aerospace, automotive, agri-food, computer games industries, banking, retail and logistics, elderly home care and hospital sectors, with more than 460 people interviewed. A detailed analysis can be found in Jaehrling (2017). Here, because it has become a key policy debate since the start of QuInnE, we focus on automation and digitisation primarily because this was an important topic in almost every sector, and also because it illustrates well the complex relationship between innovation, employment and job quality. However, we have

to bear in mind that the experiences gained from the qualitative field work are much richer than they will be presented here.

In aerospace industry, for example, there is a widespread use of digital technologies (e.g. 3D Computer-Aided-Design, computer aided manufacturing and automated processes and the use of other digital tools to organise and monitor work) in all countries investigated. However, the impact of these technologies differs greatly in the UK, France and Sweden. The introduction of 3D CAD resulted in a change in the skill needed for the execution of tasks of white collar workers. While in Sweden companies invested heavily in retraining of their employees, French companies tended to acquire new skills by firing older employees and hiring younger ones. This creates what might be called an 'age-biased technological change'. It was facilitated by the early retirement schemes available for French employees and companies – an unintended consequence of an employment policy instrument. It is also worth noting that the impact of these technologies on job quality also differed. Swedish companies were able to avoid the intensification of work-related stress and workload, while this was not necessarily the case for French companies. This is because in French companies the management took a more top-down approach in their management stlye, social dialogue and employee involvement was less intensive.

The results also suggest that blue-collar workers were impacted more negatively by automation as they lost craft dimension of their work tasks to significant degree and were restrained to control production process without direct manual tasks. The executives of the firms investigated were aware of the risks of automation, and revealed that too much automation may decrease the innovative potential of the company: "because too much automation could have negative consequences on the capacity for incremental innovations through the 'Doing, Using, and Interacting (DUI)' mode of innovation, which relies on human learning that cannot be replaced by data processing." (Gautié et al., 2017:75)

A similar pattern was observed in the automotive industry where full automation of the production processes is costly and only affordable to the largest companies. Instead of automation, the focus is put on 'smart use of manual work'. This was visible in the large German OEM's affiliate operating in Hungary, where a successful and sophisticated system was put in place in order to engage employees to take part in innovation activities. The system of 'Ideenbörse' encouraged rank and file employees to come up with their own ideas on how to cut production costs. A German supplier company deployed Japanese management style (the Kaizen method) in order to be able to produce high quality production parts and components in a highly flexible way. The competitive edge of this company was not about prices but about quality and lead time. Overall, we can see that automation can reduce production costs to a significant degree. However it is not the only option for companies to remain competitive on the market. At least until the costs of automation will not decrease remarkably. The author

summarised these experiences as follows: “It seems that the increasing needs for flexibility, together with knowledge intensive character of the work may represent significant limits for automation. The cases of the Ideenbörse and the quality circles showed similar experiences. They indicate that the control of and the knowledge about production processes is still a strategically important resource to be generated. Presently, it is limited because of increasingly smaller production batches, shorter delivery times, and a sharp price based competition which continuously force automotive companies to increasingly manage contradictory objectives, and look for good solutions and compromises by applying available production knowledge.” (Makó et al., 2017:119)

The game industry is the only sector investigated which is in an early phase of development. In this highly creative and dynamic sector all types of innovation can be found both in their radical and incremental forms. However, this innovation intensity does not necessarily result in high job quality. Moreover, most of the employees are intrinsically highly motivated, so much that they often contend with minimum level of job quality. The wages are modest compared to sectoral averages, while work intensity and working time flexibility are high. There are no trade unions active in the sector and collective interest representation is very limited. The sector can be characterized by a relatively low level of job security as temporary forms of employment dominate. However, the management of more matured companies is well aware that employees perform better in higher quality jobs, so more prestigious and established firms tend to provide higher wages, less and more predictable working time and higher job security: “They show that choices in terms of strategy can be made and that there is more than one path to competitiveness. Indeed, even in an industry characterized by project-based work, portfolio careers, temporary collaborations, self-employment and entrepreneurship high job quality in terms of working time and job security is shown to be possible” (Keune et al., 2017:254). It remains to be seen whether this will be a general trend as the sector becomes more matured or building on young, talented and creative workforce that cares less with wages and other aspects of job quality will ensure a competitive edge in the future.

The effects of digitisation were found to be more negative in the banking sector. A large trend of standardization in both back office and front office activities has been introduced in the past decade thanks to digital technologies. This development often led to a job polarisation in the workplace as new entrants most often occupy low-skilled and low-paid jobs. Similarly, to the aerospace industry, this trend of deskilling may make more difficult to shift between jobs decreasing mobility in the internal labour market. However, even in this case, the experiences confirmed that managerial choices related to work organisation, training policy, performance assessment and other aspects of working conditions play an important role. As the authors conclude: “the implementation of AI processes in a banking network shows that a technological innovation may be either helpful to improve the ability of employees, or be a threat or even an impediment to working properly according to its own vision of quality of work, and depending on the context.” (Perez&Martín, 2017:223)

Automation and digitisation are important drivers of innovation in the retail-logistics sector. Case study findings show, however, that this hasn't led to massive lay-offs in the sector. The primary reason for that is, similarly to the automotive industry, whilst it is technically possible to fully automate warehouse jobs, it is not viable economically – at least in the short and medium run. A second reason why employment did not decrease in the sector is due to the fact that the rise of e-commerce created a remarkable demand for warehousing services. Although significant job cuts have been so far avoided, automation had a strong negative impact on job quality: the majority of jobs were Taylorised, and consequently job variety has been reduced, employees perform short and repetitive tasks, with very low level of job autonomy if any. 'Hard-core' elements of job quality have also been deteriorating: employees have to be more and more flexible in terms of their working time, while their wages have not been increased or it even decreased. The automation had a deskilling effect mainly in routine-based manual jobs. The summary chapter on the findings in this sector (Jaehrling et al., 2017) illustrates well that there is no deterministic relationship between innovation, employment and job quality, even if there are undeniable structural constraints that limit the room for manoeuvre of stakeholders. The companies investigated chose low road strategies because of the enormous cost saving pressure emanating from different forms of marketization: outsourcing of logistics activities to 3PL providers, treatment of internal logistics departments as cost centres or the transformation of logistics departments into legally independent subsidiaries owned by the retail company. There is a general shift in how global supply chains are structured: retailers are tending to put more cost pressure to their logistic service providers. In this case the negative effects of market pressure is somewhat mediated by innovation, or more precisely, innovation and poor job quality are partly conditioned by the same factors. However, as the authors note, the extent to which skill requirement and employees' autonomy are reduced depends very much on deliberative managerial choices. In this context, active social dialogue at the workplace and the involvement of employee representatives has a limited potential to improve job quality. Instead, employee representatives focus mainly on employment security and on occupational health and safety, while increasing wages or limiting employer-oriented working time flexibility remain largely out of their control.

There is a huge potential for automation in the agrifood sector but – similarly to other sectors – this is not an economically viable option for most of the companies. We found one Hungarian pasta company where automation of production processes has been launched for more than a decade now. The employment outcome of this technological innovation was however positive, no massive job cuts have taken place. We found three main reasons for that. The first relates to the company ownership structure: during the privatisation process of the early 1990s, the company launched an employee stock ownership programme, together with a management buyout programme. This kind of social innovation ensured not only the urgently needed financial resources for technological and organisational renewal, but it also resulted in a cooperative organisational culture that benefitted the adoption and implementation of process innovations (automation) over the past decade. Second, the company operates in an

economically relatively underdeveloped region and being the largest employer in a rural community puts an extra pressure on the management in terms of corporate social responsibility. Therefore those employees whose jobs were substituted by automation have been re-trained and re-employed in another job of the company. Of course, the skill needs of the majority of blue-collar jobs is modest, so the employability of these workers did not increase significantly, but they did not lose their jobs either and this is important. Furthermore, this was a viable option for the company because it has a leading edge on the Hungarian market. This favourable market position made for the company possible to insource some formerly outsourced activities.

In the case of hospital sector, one of the most recent trends in the field of innovation is certainly robot-assisted surgery. The introduction of this technology required significant investments in training and skill development. This included formal and informal of training, like study tours abroad (even overseas in some cases), training at the company that developed the robot and training at other hospitals that use this technology. A special robot surgery team was set up that consists of three surgeons, three specialist operation nurses and three nursing assistants. They enjoy high level of team autonomy and discretion. An important source of employee engagement that the team members feel they are part of something new, a leading-edge innovation. The use of the robot increased job variety but did not increase work intensity as the robot can be use one day every fortnight. As one of the surgeons has to sit during the operation instead of standing over the patient, the technology has positive impact on quality of work. Although it affected only a small number of employees, robotisation did not substitute human work, instead it complemented it improving many aspects of job quality.

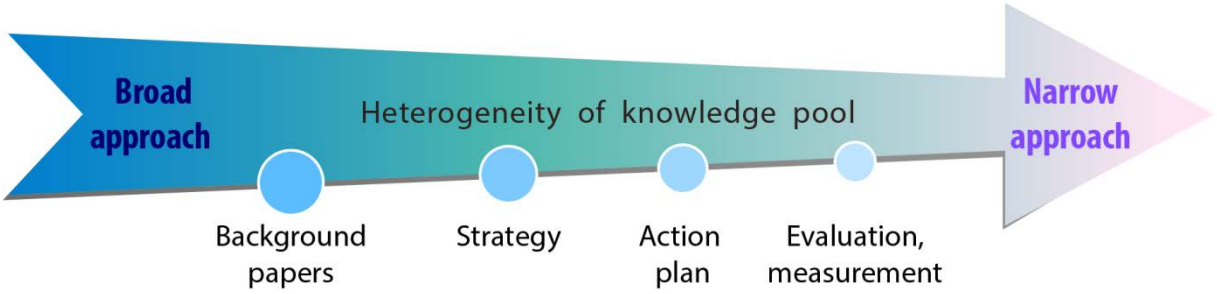
In the case of elderly home care sector, the gap between technologically possible and economically viable innovation is as large as in the case of health care. Although these jobs are both physically and psychologically demanding, the available resources are scarce and consequently innovation activity is residual and limited mainly to some organisational forms of innovation.

4. Discussion and policy pointers

Although innovation, job quality and employment have all been at the forefront of social science research for a couple of decades, the nexus between these three key notions is still blurred analytically. There seems to be a consensus among the scholars that product innovation tends to increase employment levels, whilst process innovation tends to decrease employment levels (Muñoz-de-Bustillo et al, 2017). However, systematic, evidence-based research is still needed on this topic, as the European Commission (EC, 2014c) recognises through its Horizon 2020 programme. Similarly, QuInnE case studies show that in most of the cases innovation has a positive effect on job quality by extending employees' autonomy, their increasing learning opportunities and self-fulfilment at work, though this overall positive impact is often balanced by an increase of high-workload, tightened deadline pressure and work-related stress.

It is not surprising therefore that the complex issues of job quality are poorly conceptualised at policy-making level, too. A first step towards a more comprehensive policy formulation would be a shift from the presently dominant narrow view of innovation to the broad-based approach. We argued in this paper that some elements of such a shift are already observable at European level in the most innovative countries. There seems to be a cognitive gap between the communities of researchers and policy makers: the broad approach has been presiding over the narrow approach in the scientific literature since already the early 1990s, while we find some of its elements in concrete political measures only very recently. In fact, as we move on along the policy-making process, we may detect less and less elements of the holistic approach, while the narrow view becomes dominant. In parallel with this, the heterogeneity of the knowledge pool policy making can draw on is almost inevitably narrowing in the later stages of the policy articulation process. This is even more problematic as these later stages (i.e. action plans but also such feedback mechanisms as evaluation and measurement) have much bigger impact on the real innovation performance of the European countries than the earlier surveyed European or national policy documents (green and white papers, other background analysis). The following figure illustrates this discrepancy by showing a stylized model of policy-making.

Figure 1: The characteristics of innovation policy-making process



As it was demonstrated in the analysis of the evolution of the EU's innovation policy the first phase of the policy-making process can be characterised by a relatively intensive use of broad-based approach. Already in the *Green Paper on Innovation* adopted in 1995 we found the elements of a fully applied broad-based approach. The analysis of the most relevant EU-level policy documents also revealed that this broad-based approach gradually disappears during the later stages of the process (e.g. EC 2003b; EC 2005b; EC 2008). The biggest rupture is observable when it comes to the translation of strategies into concrete action plans and policy measures. It is therefore somewhat 'obvious' that it is hard to find any element of the broad-based approach in evaluation and measurement because if the action plans are built on the traditional, STI-based narrow approach, it involves automatically that the evaluation and measurement follow the same way. It seems that the inflow of new scientific knowledge has its own 'glass ceiling' limits in this process.

We can find the reason of this phenomenon on both sides of the academic and policy-maker communities. One of these reasons is that it is more difficult to explain complex, interrelated processes, not to mention significant methodological problems related to measurement and the attractiveness of the simple indicators. In contrast, it is always easier to produce scoreboards with ex-post measurable inputs and easy-to-measure so-called 'proxies' even if the impact of these proxies on innovation is doubtful. As Havas et al. (2015) rightly noted about the 25 indicators used in the Innovation Union Scoreboard: '10 indicators are only relevant for, and a further four mainly capture, R&D-based innovations; seven could be relevant for both types of innovations; and a mere four focus on non-R&D-based innovations. Given that (i) the IUS is used by the European Commission to monitor progress, and (ii) its likely impact on national policy-makers, this bias towards R&D-based innovation is a source of major concern' (p.18). Although the scoreboard is now less biased toward the narrow-based view of innovation[24], further movement is still required if we are to properly apprehend the characteristics of the innovation process in its ampler social context, and especially its relationship to smart and inclusive growth. In its current form the IUS is not adequate in helping policy makers to identify relevant policy problems. For instance, Edquist et al.(2018) found that Sweden invested 7.35 more in innovation inputs than Bulgaria, but the "performance bonus" of this heavy investment was only 2.77 times higher at the level of innovation outputs. More differentiated measurement tools are need to achieve more grounded policy recommendations and evaluation.

[24] The scoreboard is revised each year, some variables are left out, some new ones are took in. For instance, the following new indicators were included in the newest (2017) edition of the Innovation Union Scoreboard: 'Lifelong learning (percentage of population aged 25 to 64 participating in education and training)'; 'Broadband penetration (share of enterprises with a maximum contracted download speed of the fastest fixed internet connection of at least 100 Mbps)'; Opportunity-driven entrepreneurship' measured by the Motivational Index from the Global Entrepreneurship Monitor (GEM); The 'share of enterprises that provide training to develop/upgrade ICT skills of their personnel'; 'Private co-funding of public R&D (percentage of GDP)'

Another methodological stream aimed to capture the effects of innovation in a wider perspective shifts the focus from innovative outcomes to organisational (learning) capabilities of the firms. Adapting the view of Dosi et al.(2000), Schienstock defines such capabilities as organisational competencies that 'enable firms to deal effectively in a firm-specific way with key organizational problems' (Schienstock, 2009:3) In contrast to the rather static view of innovation surveys, organisational capabilities approach aims to shed light into the black box of the organisations by focusing on those intra-firm dynamic processes through which an organisation can react to exogenous challenges. 'The capability approach is closely linked with the knowledge-based view of the firm. Organizational capabilities are identified with the know-how of a firm of performing particular problem-specific activities … Core capabilities embody proprietary knowledge that is unique to a particular firm and superior to that of the main competitors. It is widely agreed that firms' competitiveness depends on the development of only a few core capabilities' (p.3)

More recently, researchers have tended to treat innovation not as much a concrete activity on the basis that a significant proportion of innovative efforts remain unavoidably unseen. These are 'dark innovation' – as Martin called it: " … we are dimly aware of the growing amount of innovative activity that is going on but it's just not visible using existing measurement instruments". (Martin, 2016:434) Others suggest conceiving innovation as a vector (Stirling, 2007) and they try to understand and evaluate the functioning of the system as a whole, the interaction between different elements of the system, the direction of recent changes and trends, the assumed ability of the innovation to reach the objectives defined within a reasonable timeframe, etc. Innovation is rarely a single and isolated event, it is an outcome of continuous efforts. It is especially true in the context of constant organisational restructuring: in the case of most of the business and public organisations innovation is not an intended outcome of a beforehand made conscious decision but instead rather organisations constantly seek how to improve their performance. The question is, therefore, to what extent organisations are able to learn and change their daily operation accordingly. The dynamic capabilities of the firms refer to the organisational abilities to continuously renew and reallocate resources in order to remain competitive in a constantly changing environment (Nielsen, 2018).

The measurement problems of innovation lead us to the problem of policy learning which seems to be far from being able to fully exploit the results of new scientific research findings on innovation. As Borras (2011) rightly notes in one of her studies on this topic: although the purposefulness and intentionality play an important role during the process of policy making, it does not mean any way that policy learning would be an automatic or even rationalistic process. Instead: "the production and use of knowledge for identification, diagnosis and eventual policy change is embedded in complex settings characterized by specific conflict of interests, changing power relations and legitimacy conditions" (p.727) Borras goes further and poses the question as to why some countries learn faster and more than others. According to her, the answer lies in the notion of learning capacities of organisations involved in the learning process. The notion of learning capacities covers formal and informal rules and regulations, as

well as ‘structures and procedures that allow learning to take place at all levels of the system’. (p.728) Although organisational learning capacities are hard to measure empirically, EU Member States seem to show significant differences in this dimension, and higher learning capabilities are usually associated with better innovation performance. At least it is hard to imagine a highly innovative country without intensive innovation policy learning mechanisms.

Following Bennett and Howlett’s (1992) analytical framework, Borras distinguishes three levels of where this learning can take place: government, policy network (actors directly influenced by the policy), societal/social learning level. These three levels differ not only in the subjects but also in the objects of the learning processes. The following table presents the interrelationships between the level, the subject, the object of policy learning as well as their prerequisites in terms of organisational learning capacity and the levels where policy change may take place.

Table 5: Levels of policy learning, organisational capacity and their effects on policy change

Levels of policy learning	**Who learns**	**Learning about what**	**Organisational capacity**	**Policy change**
Government learning	Government and public-related organizations in the innovation system	Organisational practices/processes (administrative, management failures)	Administrative capacity	Innovation policy management change
Policy network learning	Networks of stakeholders in innovation policy	Innovation system (identifying systemic failures)	Analytical capacity	Innovation policy programme change
Social learning	Socio-economic actors in the political system	State-economy-civil society relations related to innovation and diffusion processes (innovation systems’ overall governance failures)	Major reflexive and institutional capacity	Innovation policy paradigm shift

Source: Borras, 2011:730

Flanagan and Uyarra (2014) provide an even sharper critique of innovation policy evaluations made by innovation scientists. They identified four important dangers to avoid when it comes to evaluate such policies. First, innovation scholars tend to idealise theoretical rationales and policy makers. As policy makers are attracted by the linear approach of innovation, researchers also tend to see the policy making process in the similar way: the evolution in innovation theory leads to changes in policy rationales and strategies which are then translated in shifts in policy instruments. However, policy makers are not passive recipients of evidence-informing policy advice but take an active role in the interpretation of scientific results and in drawing lessons in terms of policy instruments. In other words, the policy-making process is also constrained by the practices of the past and the interests of the present and all efforts aimed to attain changes at any stages of policy making process are biased by this path dependency. A second danger when it comes to policy evaluation is an over-rationalised view of policy design and coordination. Yet, the authors argue, the rationale, goals and impacts of the same policy instrument can and do change over time. Furthermore, these policy instruments pursue "a broad and ever-changing range of more or less explicit and implicit, final and intermediate goals and objectives" (p.5). A further misunderstanding toward innovation policies is treating them as tools from a toolbox that can be used independently from time and space, the institutional context of a given country. The impact of the simplest policy instrument may vary according to the differences in its implementation. That's what the authors call 'interpretative flexibility': "Instruments are interpreted differently by different actors and reinterpreted over time in the light of changing policy thinking" (p.4).

These points are even more important as the concept of innovation has become more diffuse as it has become more ubiquitous. Innovation is now everywhere, with the emergence of such notions as service innovation, public sector innovation, frugal innovation, design-based innovation, user-driven innovation, business model innovation, etc. As the number of innovation researchers dynamically grows, it appears in more and more segments of the society and the economy and in a more complex way. We now have better understanding of the nature of innovation processes than a few decades ago. However it is still no easier to narrow the cognitive gap between researchers and policy makers. On the contrary, the newest results of innovation studies from various fields raise concerns about the validity of such basic definition as the classification of innovation laid down in the Oslo Manual (2005). Edquist (2014), for example, implicitly proposes the revision of the traditional classification of innovation that distinguishes between technological and non-technological innovation, the former including product and process innovation, while the latter consisting of marketing and organisation innovation. Instead, Edquist argues, it makes more sense to distinguish between product and process innovation. Product innovations cover material goods as well as intangible services. In contrast, in the case of process innovation the question is how the products are produced and this may relate to either technological or organisational innovation.

In a recent Eurofound (2017) report, the authors also stress that the definition of organisational innovations is poorly developed compared to those of other and especially product innovation. This often leads to problems concerning how to distinguish this particular form of innovation from other types of innovation and it is often not clear whether certain innovative organisational arrangements are a necessary precondition for innovation (as suggested by the learning organisation theory) or simply a consequence of other innovative activities. Consequently, considerable efforts have to be dedicated to clarify what actually is organisational innovation and what is its relationship to other forms of innovation. In their analysis, the authors consider organisational innovation as a precondition for innovation and use the answers to this question as an independent variable. The authors argue that one possible reason of this shortcoming is that innovation studies are primarily of economic interest. This is especially important under the current policy regime which aims to reach not simply economic growth but one that is also sustainable and socially inclusive.

The interrelationship between innovation and inclusivity is a relatively new topic on innovation research agenda but is of particular interest from point of view of the QuInnE project. It covers, among others, two generic questions: what are the direct and indirect impacts of various forms of innovation (e.g. in terms of employment or job quality outcomes) and how are the collective and individual benefits of innovation distributed in the society. As concerning the first question, QuInnE project's research results show that generally speaking there is a positive correlation between job quality and innovation as well as between innovation and employment. However, not all types of innovation increase job quality or boost employment, and the nexus between them may vary from country to country depending on the country-specific institutional arrangement. As Hunt et al (2018) found, reduced inequality, as measured by higher employment participation and better job quality, is not comprehensive for vulnerable workers within a high innovation regime. Indeed, they note, there is no clear evidence that high innovation can be expected to inevitably reduce inequality for these workers. These findings suggest that reductions in inequality cannot simply be inferred from innovation. It is possible that as innovation increases the possibilities for improvements in job quality, the scope for inequality between the least and most vulnerable increases on some measures. One reason for this outcome may again related to intervening country-level labour market policies, with these authors also pointing to the example of the Nordic countries in this respect..

As concerning the second question about how to share the wealth created by innovation, Lazonick and Mazzucato (2013) propose an analytical framework which is worthy of note from an innovation policy point of view. They pick up three intrinsic characteristic of any innovation process: (1) uncertainty means that there is always some level of risk around innovations, (2) the collective character of innovation creates a chance and "a rationale for the widespread and equitable distribution of the gains to innovation" (p.1103) but (3) the cumulative character of innovation makes it possible to certain stakeholders to extract values at some point of the

innovation process that is disproportionate to the risks taken[25]. In their 'risk-reward nexus' (RRN) framework, the authors analysed who takes the risks and who reaps the rewards in the innovation process. They found that whilst risks are distributed fairly collectively in the society (basic research being funded from taxpayers' money, for example), "the reward system has become dominated by individuals who, inserting themselves strategically between the business organization and the product market or a financial market, and especially the stock market, lay claim to a disproportionate share of the rewards of the innovation process". (p.1095) A series of changes in the institutional (especially financial) regulation[26] made it possible for top executives, venture capitalists, Wall Street bankers, hedge fund managers to extract billions of US dollars from a process that originally involved contribution from a much wider segment of the society.

Analysis of the most recent EU- and country-level innovation policy documents clearly shows that policy learning is even more important now than ever as we are facing to a new socio-economic paradigm. The fourth industrial revolution – with its buzzwords such as Industry 4.0, digitalisation, automation, additive manufacturing, Internet of Things, etc. – represents a new socio-technological paradigm and the adaptation to these grand challenges is a major concern in all Member States . However, these strategies differ greatly in terms of how they approach to digitalisation (e.g. a purely technological question vs. societal challenge), how many stakeholders are involved in the elaboration of the strategy. In other words, although a thorough analysis would exceed the limits of this paper, one could easily evaluate these strategies along the dimensions of the broad vs. narrow scale presented in the first section.

As of now, there are scattered empirical experiences on the impact of digitisation/Industry 4.0 on the innovation-job quality-employment nexus. Among the few studies focusing on the economic impact (e.g. employment) of digital technology one of the most convincing call attention on need to use the wider complex view of the technological changes. In the conclusion of their research, the authors stress that '... dealing with digitisation and assessing its economic impact requires to overcome the traditional and narrow infrastructural, supply-side, and technology-based perspective of ICT. This change of perspective asks for adoption of a more complex and multidimensional view on the relevant dimensions and mechanisms governing relationship between ICT and the economy' (Evangelista et al., 2014: 26). Another recent analysis of PIAAC survey data calls the attention to the core role that skills, training and retraining play in helping the smooth move from high to lower risk of automation (Arntz et al., 2016). This result is confirmed by our qualitative empirical evidences that showed that the impact of automation on employment may greatly vary according to certain managerial choices

[25] „This cumulative character makes the innovation process highly dependent on access to financial resources that will sustain the innovation process from the time at which investments are made until it can generate financial returns." (Lazonick and Mazzucato, 2013:1101)

[26] For example, the creation of the NASDAQ with less strict requirements than that of New York Stock Exchange in 1971, the lowering of the capital-gains tax rate from 40% to 20% between 1976 and the early 1980s, allowing for employees' pension fund managers to invest in highly speculative venture capital funds, etc.

and to the training policies of business organisations. A new pool of skills can be achieved either by the retraining of (older) personnel or via hiring new (younger) employees (cf. age-biased technological change).

It is clear, that the future relation between job quality, innovation and employment will be reshaped remarkably by the digital technologies as a core driver of the social-economic transformation. The structural and cognitive holes and obstacles in the current state of European innovation policy learning mechanisms preventing the shift from the narrow to the broad-based innovation policy approach represent a critical risk in fully exploiting the opportunities offered by these grand challenges in the perspective of inclusivity.

Taken into account of these considerations, we propose the following policy pointers for further reflections.

Table 6: Summary of research conclusions and policy pointers

Conclusions	Policy Pointers
There is a cognitive gap between innovation policy and innovation research.	Need for the application of the broad-based innovation approach in the policy formation.[27]
Measurement tools are partial or inappropriate to evaluate and to give feedback to innovation policies and therefore needs to be renewed.	Basic notions of innovation and especially organisational innovation need to be revised.
	Innovation Union Scoreboard has to be complemented by new indicators that are able to embrace innovation in a more complex way.
There are no universally applicable policy tools.	Policy instruments have to be designed taking into account country-specific characteristics in terms of stakeholders' (potentially conflicting) interests and goals.
Although 'enterprises are at the heart of the innovation process', the governance structure of innovation is still bounded by the R&D&I approach of the old paradigm.	New type of governance is needed for innovation that reflects better the special characteristics of innovation and able to take into consideration a broader range of its preconditions and impacts (taxation, social policy, competitiveness, environmental protection, skills, etc.) especially if the aim is to achieve sustainable and inclusive growth
The problems of policy learning are a neglected but at the same particularly important dimension of innovation policy.	Learning capabilities have to be developed at all levels of policy formation: governmental, policy networks and societal levels.
Inclusiveness is still an under-investigated dimension of innovation.	More research needed about what are the direct and indirect impacts of various forms of innovation and how are the

[27] That is: acknowledging the importance of practical, tacit and collective knowledge in incremental innovations in all sectors of the economy; the importance of non-technological forms of innovation and the DUI-mode of innovation beside the STI-mode, etc.

	collective and individual benefits of innovation distributed in the society.
Technological changes do not have automatic effects on employment or job quality but these effects largely depend on managerial choices, values and institutional arrangements.	The innovation policy has to address this challenge in order to be able to maximise the benefits and minimise the risks of such global trends as automation, digitisation, robotisation and to avoid trade-off between employment and job quality.
Individual and organisational learning is a core issue of any innovation policy.	Evidence-based policy needed on how to improve innovation-friendly skill pool and how to promote learning capabilities.

In parallel with these suggestions towards the community of innovation policy makers, the innovation scientists should also recognize that important changes have been made in the theoretical background of the current innovation policies under the Horizon 2020 strategy. This provide a unique opportunity to take a step back and reflect on the reasons why the academic community have been until recently less capable to explain the theoretical position and the practical consequences of the systemic approach. This requires to rethink the traditional way of formulating policy recommendations and to provide more practical research conclusions that are relevant for different actors at different stages of policy making process. There might be various paths to do so: 'One way to overcome this deficit of capability is for academics to work with think-tank. Think-tanks specialise in bridging the gap between academic research and policy practice. Their stated intention is to influence public debate and typically have the capabilities and conduits to engage policy-makers.'[28] Similarly, it would be beneficial to strengthen the professional dialogue between the academic community and experts involved in different levels of policy making process. This would allow reaching a deeper understanding of each other's point of view and reasoning and thus it would be easier to mutually unlock cognitive path dependencies. These new communication spaces to be built with the aim of fostering social dialogue would connect not only leading researchers and top level policy makers but a broader range of actors involving Commission staff members, think tanks and national innovation policy advisers.

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