Lars Fredrik Andersson, Antti Alaja, Daniel Buhr, Philipp Fink, Niels Stöber

Policies for Innovation in Times of Digitalization

A comparative report on innovation policies in Finland, Sweden and Germany

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- Decent work and social progress.

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PREFACE

Digitalization is one of these terms that everybody knows and connects with while it is, at the same time, hard to pin down what it actually means. According to current research on digitalization, one thing is certain: it has changed work places, work-life balances and worker's position in the labour market and will do so in future while simultaneously creating booming markets in a more and more globally networked society. Much has been written about the need for economic policy to foster and develop innovations in this new digital framework as a means for growth and employment.

At the same time concerns over possible detrimental impacts on employment and income have been voiced. A more socially inclusive innovation path calls for innovation policy to focus not only on the technological dimensions of digitalization. Instead, digitalization should be seen as a social innovation, enhancing social progress. Hence, this study analyses three national innovation systems in their quest to harness the digital age. By doing so, it envisions a progressive and cross-national innovation policy framework that takes the idea and need for innovations beyond growth-parameters and singular competitiveness issues towards a socially inclusive, sustainable and just understanding of state-driven innovation policy.

This study has been realized by a broad cooperation of progressive think tanks, including the Friedrich-Ebert-Stiftung in Stockholm and Berlin, Sorsa Foundation in Finland and ArenaIdé in Sweden. In several workshops the core group of authors discussed their angles and ideas with national experts from Germany, Sweden and Finland which resulted in this study – many thanks to all participants in these workshops and especially to the authors Antti Alaja, Lars Fredrik Andersson and Daniel Buhr.

We hope to give an insight into the central questions concerning the social and technological aspect of innovation policies in an increasingly digitalized society. We need an open discussion among progressive political actors and across national borders, especially within the EU. A broad policy framework is required that focuses not only on growth statistics and competitiveness, but on society and the workers most affected by digitization.

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INTRODUCTION: SOCIAL INNOVATION IN THE DIGITAL AGE

WHY A STUDY ON INNOVATION POLICIES?

The digitalization of economies and societies represents one of the "grand challenges" faced by European societies in the twenty-first century, along with issues such as demographic ageing, climate change and increasing inequality. This study examines the role of innovation policy in the digital age. We start from the observation that state innovation policies represent central elements in both solving and preventing societal problems ensuing from transformations of economy and society. A comparative study of the current state of innovation policies and the role of the current state for innovation in Sweden, Finland and Germany provides the background for recommendations for a progressive innovation policy that sees innovation not only as a path to economic growth but also as a crucial tool for tackling societal challenges. The main question of this comparative survey is: How can technological innovations evolve into social innovations in order to promote social progress?

Within this framework it is important to understand, firstly, that innovations in the form of social innovations are crucial for tackling societal challenges. Secondly, the comparative approach of this study frames the role of the state as an active promoter of innovations. Thirdly, the central questions raised in this study are crucial to understanding the final crystallization of progressive innovation policies.

INNOVATIONS AS AGENTS OF CHANGE

The common perception of innovations is biased towards technology. Innovations are often referred to as the path to economic growth, enabled by entrepreneurial visionaries ("Silicon Valley") and promising game-changing technological and product revolutions. However, innovations are more than just new technologies, enabling new products to be sold in new emerging markets – which they have not infrequently created themselves. Innovations in telecommunications (telegraph, telephone, radio, TV, internet), transportation (trains, cars, planes) and health and hygiene (penicillin, X-rays) have not only created markets for products, but have often helped to solve societal problems. At the same time, innovations are ambivalent. They can cause adverse effects through their game-changing nature. Structural change caused by productivity increases can have detrimental effects on employment and labour relations, as well as in some cases on social relations. It is probably no accident that a single machine (the steam engine) stands symbolically for an entire industrial revolution and the appearance of a new system of social relations.

Many observers compare the current technological process of digitalization to the game-changing impact of steam power. In their view this so-called "second machine age" (Brynjolfsson/McAfee 2014) will have similar consequences for labour and social relations. Twenty-first-century societies will experience a period of intense transformation due to innovations that have appeared over the past few decades (Rifkin 2014). In Germany, the current debate on the predicted digitalization of its industry is labelled a "mega-trend" with the potential to significantly change both production processes and labour relations during the coming years. At the same time, studies in Sweden and the United States gloomily predict that more than 40 per cent of current jobs are at risk during the next two decades due to digitalization of industry and services (Frey/Osborne 2013; Fölster 2014).

Alongside changes due to the digitalization of industrial production and social relations, societies already face several "grand challenges" at the beginning of the twenty-first century: demographic ageing, climate change and increasing inequality to name a few. Innovations can promote technological development such as the digitalization of industry, households and governments, but they can also be used to tackle societal challenges. In this case, technological innovations become "social innovations". In a paper analysing the status quo, the development and the consequences of industrial digitalization in Germany ("Industrie 4.0"), Daniel Buhr (2015) defines "social innovations" as both promoting the distribution and diffusion of technological developments to a societal level and representing practices dealing with societal challenges, which are developed and used by affected individuals, groups and organizations. Following Howaldt and Kopp (2012: 47), a social innovation is a new configuration of social practices in particular areas of action or social contexts prompted by certain actors or constellations of actors in an inten-

tionally targeted manner with the goal of satisfying or answering needs and problems better than is possible on the basis of established practices. According to the Vienna Declaration (2011) social innovation is an urgent alternative to technology-oriented innovations that fail to solve the great societal challenges we are now facing.

However, the trajectory technological innovations take with respect to their effects on society depends on the responsiveness of the latter. This in turn is invariably the result of policies that attempt to steer the path of technological innovations. A progressive innovation policy must therefore not only focus on technological developments, but has also to conceive innovations as central elements in promoting social progress. By focusing on societal needs, the state has to become an active and central player (actor) in promoting, developing and regulating innovations. More importantly, the state has to promote innovations in areas where market actors fail. Mariana Mazzucato, studying the emergence and development of innovations in twentieth- and twenty-first-century Western societies, states that "the state has historically served not as a meddler in the private sector but as a key partner of it … Across the entire innovation chain … governments have stepped up with needed investment that the private sector has been too scared to provide" (Mazzucato 2015).

Such a state is not only a driver of innovations, but ideally has the capacity to understand and analyse possible challenges to society. As David Runciman argues, by looking at both the societal challenges mentioned above and also political participation, citizen interaction and the way in which the internet and social media can have redistributive effects, a progressive innovation policy may focus on enabling and guaranteeing the positive social effects of both technological and social innovations, independently of corporate power (Runciman 2015). In times in which the digital economy is transforming both economic and social life, a progressive state cannot serve as a mere bystander, but must find ways to channel technological and social transformations for the benefit of the great majority in society (Runciman 2015). As Brynjolfsson et al. (2014) argue, increasing digitalization of the economy and society can lead to positive developments regarding living conditions and social inequality, but there is also a high risk, looking at the transforming labour market for the unskilled and low-skilled labour force, that negative trends (such as growing inequality and concentration of capital) may be reinforced. A progressive innovation policy, they argue, must focus on an active role of the state in ensuring and regulating investments in fields such as education and basic research to safeguard a positive development of the "second machine age" (Brynjolfsson et al. 2014). Progressive innovation policy must therefore simultaneously aim at the greatest possible diffusion of technological innovations (i.e. digitalization) within society and to ensure maximum participation. This entails the creation and regulation of markets as well as intervention in market actions.

WHAT IS THIS STUDY'S CENTRAL INTEREST?

The comparison focuses on three country-specific analyses of innovation policies in Finland, Sweden and Germany. All three are ranked as leading innovators (European Commission 2015). All three are also progressive EU members, which enables a discussion of open-minded European innovation policies based on country-specific analyses.

Nevertheless Finland, Sweden and Germany have historically had – and still have – different approaches to innovation policy. While the Nordic countries tended to link innovation policies to challenges and developments in their welfare states, German innovation policy has mostly focused on solving technological – export-oriented – challenges. A comparison of how these different approaches characterize each country's institutional framework and focus in innovation policies today, and which strengths and weaknesses these involve, will be central to improving our understanding of a possible progressive agenda in innovation policies.

Based on the arguments outlined above, the central question concerning a progressive innovation policy is thus: what role should state innovation policies and institutional frameworks play in stimulating, detecting and regulating innovation in such a way that it serves society as a whole and improves living conditions of the majority of people?

The basic framework for this study on innovation policies in Finland, Sweden and Germany is structured by the understanding that the state is an active agent of innovation in various fields (for example digitalized economy) through both technological and social innovation policies. Several central questions guide the analysis of Finnish, Swedish and German innovation policies and the authors' policy recommendations presented in a concluding discussion. First of all, a discussion of the "status quo" of innovation policies, with a specific focus on societal challenges and social innovation, is framed by the following questions:

- How is the debate on innovation and innovation policy and industrial policy structured in Finland, Sweden and Germany?
- How is innovation policy framed institutionally in the three countries?
- What are the strengths and weaknesses of current innovation policies in Finland, Sweden and Germany, looking at both technological and social innovations?

Based upon a comparative perspective, possible progressive elements of innovation policy can be detected. For this purpose we will also touch upon the identification and promotion of innovation processes.

Furthermore, linking the importance of social innovations to the process of technological development and innovative processes will be of central interest. Considering this, we will focus on the question of how innovation policies can be connected to the digitalization of economy and social life. These questions also guide the discussion of policy recommendations for a progressive innovation policy on the national and European levels.

HOW WE PROCEED

Framed by these questions, the three country studies on the status quo and developments in Finnish, Swedish and German innovation policies are complemented by a discussion of possible progressive innovation policies treating innovations as not only creating new markets but as solutions for societal challenges and promoting a socially beneficial development of the digital economy. As argued above, there is a need for progressive sections of society to engage in innovation policies if the aim is to attain social progress through both technological and social innovations. As Mazzucato also emphasizes, discourse on innovations has too often limited the sphere of actors mainly to smart entrepreneurs and visionary investors while other actors in society have been excluded. This study attempts to highlight a progressive innovation policy that links the economic importance of innovations and technological developments to possible solutions for societal challenges that may affect the majority of people.

In the following chapters, the discursive and institutional frameworks of innovation and innovation policies in Finland, Sweden and Germany are discussed. Here, the authors highlight both the basic frameworks and also explicit examples of innovation processes that link technological development and societal challenges.

Firstly, Antti Alaja discusses the Finnish case with a focus on Finland's unique institutional framework for innovation policies and the relevance of social innovations outside those focused on export industries. Secondly, Lars-Fredrik Andersson analyses the status-quo and current developments in Swedish innovation policy frameworks, looking both at digitalization of its industry and social innovations, and the strengths and weaknesses of Swedish innovation policy. Last but not least, Daniel Buhr reviews German innovation policy and its development focusing on both "Industry 4.0" and social innovation. Following the country-specific analyses, a conclusion summarizes strengths and weaknesses of different approaches to innovation policies to sketch a progressive innovation policy that combines the importance of technological development, economic performance and social welfare. Central questions are: "What can we learn from these different approaches? Which are the central elements required in a progressive innovation policy that takes social innovation seriously?" Here, a European perspective will be outlined as well.

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ANTTI ALAJA

2

COUNTRY CHAPTER FINLAND: TAKING A WORRISOME TURN?

INTRODUCTION

The Finnish economy has gone through a prolonged double dip depression and structural crisis since 2009. In the late 1990s and early 2000s the Information Communications Technology (ICT) cluster built around Nokia was a major source of productivity growth, but this high productivity period has come to an end since the global financial crash of 2009. Industrial jobs have also been lost in ICT, metal and paper sectors, and Finland's export performance has been anemic (Suni and Vihriälä 2016). In recent years the former model economy of the Eurozone has become one of the growth and productivity laggards in Europe. The prevailing mood in Finland is sceptical towards the future prospects of the economy.

One can, however, argue that in terms of various innovation and structural competitiveness indicators, Finland's strengths are still, at least to a large extent, present. In comparison to other EU member states Finland is one of the innovation leaders (European Commission 2015), which means that innovation performance is clearly above the EU average. Finland was ranked number one in World Economic Forum's (2015a) most innovative countries. R&D intensity of the Finnish economy has, however, declined in recent years. Recent education and R&D expenditure cuts of the previous and current government pose a threat to the future of Finnish research system and innovation-led growth.

Finnish economic policy debate in recent years has focused much on the eroding price and cost competitiveness of export industries and wage rigidities, but the great challenge for the Finnish firms is to regain its real competitiveness though producing innovative services and products that bring high value added. It has been hoped that industrial internet could revive the Finnish industrial sector. Finland should once again see public education, R&D and innovation expenditure as key investments for the future. Progressive innovation policy for the future should move from narrow competitiveness legitimation towards solving societal problems and challenges, and promote innovative public procurement.

INNOVATION IN FINLAND – FACTS AND FIGURES

Finland experienced a severe financial and economic crisis in the early 1990s, which led to unprecedented decline in GDP and mass unemployment. The Finnish economy quickly recovered from the crisis in the late 1990s. The strong performance of Nokia and ICT together with the boom in the industrial sector contributed to the industrial revival, and the Finnish economy experienced an era of strong export-led growth. Finnish R&D input grew continuously and Finland became one of the global top performers in terms of R&D input in the late 1990s and early 2000s. The R&D activities of one company, Nokia, explain much of the growth, but the Finnish public sector also increased its R&D expenditure significantly. Especially in the latter part of the 1990s, Finland reacted to the crisis through investing in education and public R&D spending (OECD 2009).

During the current crisis Finnish firms and government have not reacted to economic difficulties through additional R&D investment. After 2011 both public and private R&D expenditure started declining as figure 1 demonstrates. In 2014 Finland's R&D intensity was, however, still the highest in the EU (3.17 per cent) before Sweden (3.16 per cent) and Denmark (3.08 per cent). 68 per cent of the Finnish R&D was performed by the business sector, 9 per cent by the government sector and 23 per cent by the higher education sector (Eurostat 2015). Finnish business sector R&D is mostly performed by Finnish companies, and foreign companies performed only 15 per cent of the business sector R&D in 2011 (Rikama 2015).

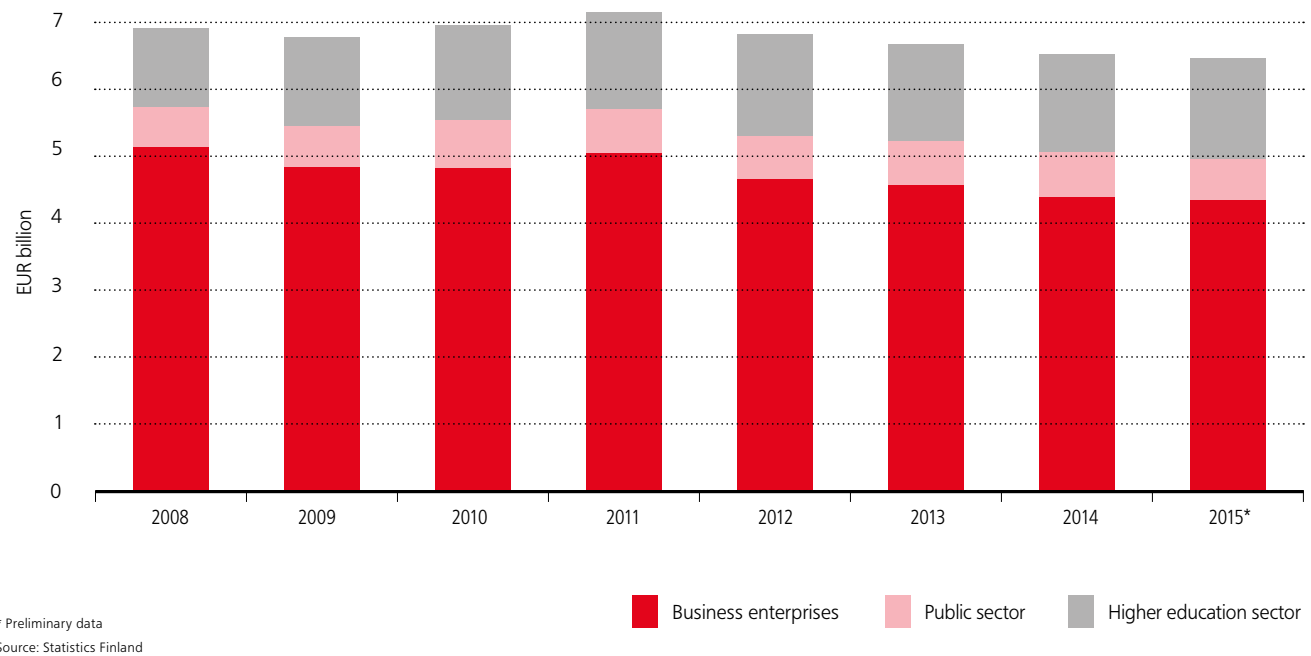
According to the state budget the share of public research funding to Finnish GDP is 0.87 per cent in 2016, which is clearly above the EU average. Overall government sector's R&D spending amounts to 1.845 billion Euro in 2016. In 2016 universities received 31.7 per cent (585.5 million Euro), innovation funder Tekes 20.7 per cent, and research funder Academy of Finland 23.8 per cent, and government research institutes 10.7 per cent of the total government R&D funding. If one analyses government R&D expenditure through socioeconomic objectives, the Finnish government allocated 57.8 per cent to

general advancement of knowledge (mostly through universities and Academy of Finland) (Statistics Finland 2016). Public R&D funding to promote industrial renewal and technological progress has significantly decreased in recent years.

EU Commission's Innovation Union Scoreboard's comparison of innovation input indicators demonstrates that in international comparison Finnish innovation system has various strengths such as highly educated workforce, firms and public sector's high R&D expenditure, and innovation collaboration networks (European Commission 2015). The World Economic Forum (2015b) has also recently emphasized that "Finland 's biggest competitiveness strength lies in its capacity to innovate, where the country leads the world rankings (1st). Very high public and private investments in R&D (3rd), with very strong linkages between universities and industry (1st) coupled with an excellent education and training system (1st)." In the case of innovation inputs, it is not Finland's current relative performance, but the direction of change that is worrisome. Public R&D expenditure decreased every year between 2011–2014, and Juha Sipilä's government cut the 2016 public R&D budget with 157 million Euro[1]. Public R&D expenditure shrank by 9.4 per cent in real terms in 2016. Innovator funder and networker Tekes, which had already faced significant cuts in previous years, lost nearly a quarter of its funding (Statistics Finland 2016). University of Helsinki,

1 Juha Sipilä's government was formed in May 2015. The government consists of the Centre Party, the National Coalition Party and the True Finns.

Figure 1
Finnish R&D expenditure by sector in 2008–2015



* Preliminary data
Source: Statistics Finland

which often ranks among the top 100 universities in the world, is faced with funding cuts amounting to 83 million Euro until 2020. It was forced to lay off around 1.000 persons in early 2016. There is now a concern that cuts might endanger the future of the university and research system and the prospect of innovation-led growth.

According to the European Union Innovation Scoreboard (2015), output indicators Finland is below the EU average in economic effects of innovation. This category includes employment growth in knowledge intensive activities, exports of medium and high-tech products, exports of knowledge-intensive services, sales due to innovation activities and license and patent revenues from selling technologies abroad. In 2005 the proportion of high tech exports out of all exports was over 20 per cent, but in 2014 the proportion of high tech exports out of total exports had fallen to 7 per cent. Finland has in fact become the net importer of high technology products. The crisis of Nokia and the ICT sector explain much of the collapse in high technology products.

INNOVATION POLICY AND ITS INSTITUTIONAL SETTING

Modern science and technology policy arrived to Finland around mid-1960s. There was a crisis debate within key economic policy makers at the time that Finland cannot build its future solely on forestry export sector and around adapting foreign technologies and know-how. Finland must catch up with countries that have a more advanced knowledge base. In the late 1960s Finland extended its university system to various peripheral cities, the number of university students increased significantly, the Ministry of Trade and Industry started supporting industrial research, the National Fund for Research and Development (Sitra) was established, and the Academy of Finland was reformed to become a modern funder of scientific research. The Science Policy Council chaired by the Prime Minister was established in 1963 to coordinate research activities (Murto et al. 2007).

Researchers such as Tarmo Lemola have emphasized that Finland adopted policy instruments and doctrines from countries that were considered to be successful or more advanced from the Finnish point of view. In welfare state history it is often mentioned that modern Finnish welfare state development took off later than in other Nordic countries. The birth of modern science and technology policy also happened later in Finland than in Sweden, Germany or other leading OECD countries. Finland, for example, followed Sweden's lead in establishing the Science Policy Council and Sitra. In the 1970s, 1980s and 1990s the OECD had a very significant influence on Finnish science, technology and innovation policies (Lemola 2003).

In the 1960s and 1970s many traditional companies in Finland still did not understand the value of R&D and innovation activities. Breznitz and Ornston (2013) have claimed that especially Sitra acted as a Schumpeterian public agency in the 1970s promoting innovation. Politicians in general were not too interested in its operations, so it had strong autonomy to be visionary. Sitra emphasized the role of industrial R&D, and invested in electronics before it was generally considered to be important.

The 1980s, on the other hand, has often been called as the era of technology policy in Finland (Lemola 2003), because technology was conceived as the key to the future competitiveness of the Finnish industry. Technology and innovation funder agency Tekes was established in 1983, and since the mid-1980s it has been the most important public innovation funder of Finnish companies. In the 1980s public funding for technology policy programs increased heavily, and Tekes started promoting research collaboration. The Science Policy Council was renamed Science and Technology Policy Council in 1987. According to SFINNO database maintained by Technical Research Center VTT, Tekes funding played a part in over 60 per cent of innovations commercialized by Finnish firms in 1985–2007 (Hyytinen et al. 2012).

The role of Technical Research Center VTT has also been vital in the development of the Finnish innovation system. According to its webpage VTT is nowadays "the biggest multi-technological applied research organization in Northern Europe." It is the biggest research institute in Finland, which uses its resources to generate new data, knowledge and innovations. VTT, like the German Fraunhofer Institute, has also been highly successful in competition over the EU's research funding. It is one of the oldest organisations in the Finnish innovation system, established in 1942 (Loikkanen et al. 2013).

It should also be noted that the orientation of Finnish technology policy became more international in the 1980s and 1990s, as the Finnish economy became more open. Finland joined the Eureka program in the mid-1980s, which was a significant step towards European R&D cooperation. Finland also started taking part in European Commission's research programs in the late 1980s before joining the EU in 1995 (Lemola 2003).

In the early 1990s Finland was the first country to adopt a national innovation system as an organizing concept of science, technology and innovation policy in 1990 (Miettinen 2002). Building the innovation system has even been characterized as the official state ideology in the 1990s (Aro & Heiskala 2015). It has, however, been argued that major institutions such as Science Policy Council, Sitra and Tekes had already been established during the previous decades, and that the concept of national innovation did not indicate a significant paradigm change at the policy level. There were obviously new elements in the institutional set-up of the innovation system as well. Regional innovation policy became more important in the 1990s through regional strategies of major cities such as Tampere and Oulu. The Finnish system of polytechnics became vital in promoting the regional development.

Social innovation also became a major theme in Finnish innovation policy debate in the late 1990s and early 2000s. Innovation was considered to be too focused on technology and competitiveness (Hämäläinen & Heiskala 2007). In the late 1990s Finnish society has become more unequal and income inequality increased significantly. Reijo Miettinen (2013) has contributed to the debate concerning a virtuous circle between the development of the innovation economy and the Finnish welfare state. Miettinen emphasizes that social investments such as kindergartens and comprehensive school system have contributed to cultivating human capabilities and the innovation economy. Before the global financial crisis

broad-based innovation, service sector innovation, demand-side policy, user innovation and open innovation also became major topics in the Finnish policy debate (Lemola 2010).

Strategic Centres for Science, Technology and Innovation (SHOKs) were a major initiative by the Finnish Research and Innovation Council in 2007. The aim of the strategic centres was to bring academics and businesses together to define strategic research agendas, which could further social and industrial renewal[2]. However, the SHOKs have been under severe criticism in recent years, and the Sipilä government has stated that it will stop supporting the SHOKs during the next 3 years. Sipilä government has also been unwilling to give Science and Innovation Policy Council its prior role as coordinator of STI policy.

Innovative public procurement has also become a major topic within the past ten years. Sipilä government has set a goal that at least 5 per cent of public procurement programs should be innovative in 2019. As the CEO of Tekes, Pekka Soini, has emphasized, the public sector procurement is worth 35 billion Euro annually, and reaching the target would mean 1.7 billion Euro annually for new innovative activities. There are hopes that innovative public procurement could provide reference markets for the Finnish growth companies, but in recent years the scale of innovative public procurement has still been modest.

The Finnish start-up scene has gained attention both nationally and internationally in recent years. The Start-up event Slush is an example of the buzz around innovative start-ups in Finland. In November 2015 Slush gathered 15.000 visitors to Helsinki Congress Center making it a leading investor and start-up event in northern Europe. Student activists at the Aalto University have been instrumental in building the Finnish start-up scene, and there is an expectation that young Schumpeterian entrepreneurs can renew the Finnish economy along with established firms. In the context of successful start-ups it should be noted that the games industry has been one of the most dynamic sectors of the Finnish economy in recent years. Success stories include Angry Birds by Rovio and Clash of Clans by Supercell (See Tekes 2015).

CHALLENGES: PROMOTING INDUSTRIAL AND SOCIETAL RENEWAL THROUGH DIGITALIZATION

Finland has been stuck in a structural crisis, which has led to poor labour productivity growth. New industries have not yet compensated the loss of production and jobs in ICT, metal and paper industries. As in many other countries, there is belief that digitalization can revive productivity growth in the Finnish private and public sector. Economics professor Matti Pohjola (2014) has argued that the productivity growth potential of the ICT and digitalization is immense, and that the "best is yet to come" for Finland and other countries that can make use of smart technologies.

Pohjola emphasizes that Finnish recipe for growth can be based on industrial internet, which combines industrial products and services (Pohjola 2014). It is certainly true that there are various medium-size industrial companies in Finland such as Kone Corporation, Wärtsilä and Cargotech that have potential to deploy the industrial internet. Nokia has also been making a comeback through 4G networks, and in 2015 it's R&D investment started increasing again.

There are indicators that emphasize that Finnish companies and public sector organisations have not used their full potential in digitalization. Finland was, for example, ranked second out of 22 countries by the Digibarometri report, which is published by various Finnish organizations such as Ministry of Transport and Communication, Tekes and the Federation of Finnish Technology Industries.

Finland seems to have good preconditions to utilize digitalization, but application of digitalization is inadequate. For example, Finnish companies have not been successful in developing online sales. There has also been a debate that Finland has not had a clear strategy for digitalizing the public sector. Many civil servants, commentators and decision-makers seem to think that Finland needs a more holistic and centralized strategy for public sector digitalization (DIGILE et al. 2015).

POLICY RECOMMENDATIONS

In the late 1990s and early 2000s Finland was one of the innovation leaders within the EU that patiently invested into its education and innovation system. Actually the significance of knowledge and innovation was already understood in the 1960s, when the modern science and technology policy was institutionalized. Public innovation policies of the past years can be seen as a paradigm shift in the history of Finnish technology and innovation policy. The Finnish governments since 2011 have not stabilized, but aggravated, the crisis in Finnish innovation input. Finland is still doing relatively well, but it is not the current performance, but the long-term trend that is alarming. There are fears that companies, R&D activities and successful researchers might be leaving Finland, if Finland continues its current policies.

One plausible explanation for the current policies is the ideological idea that innovations stem solely from start-ups and private companies, and that the role of the state is to "stay out of the way". The Sipilä government emphasizes that labour market deregulation and cutting public expenditure could revitalize the Finnish economy in the coming years. Popular austerity rhetoric around cutting the red tape sees the state as the problem, and not as the patient and long-term funder of technology and innovation activity. If Finland wants to return to innovation-led growth, it should return to a policy model where public education and R&D spending are seen as key public investments for the future.

There is huge economic and societal potential in innovative public procurement in Finland. Senior Adviser Jussi Kajala from Tekes has emphasized that innovative public procurement would improve the productivity of the public sector through smart solutions and provide reference markets for the Finnish start-up firms. Civil servants working in the field of public procurement should become less afraid of failure.

2 They have operated for example in the fields of energy, environment, construction, ICT and metal industry. In 2014 Tekes provided 88 million Euro for the SHOK programs.

Kajala proposes that Finland needs a new organsation or central authority that would advise Finnish municipalities and other public agencies on how to proceed in innovative public procurement.

Since the 1980s Finland's technology and innovation policy has been legitimated through a pragmatic competitiveness perspective. As a consequence, many progressives dislike the current political rhetoric over innovation. Innovation policy makers and politicians should speak more clearly on the economic, social and ecological challenges and the practical questions that the state's investment and innovation policies are trying to solve. Finland's innovation policy model should become more mission-oriented, where the state identifies social challenges and problems that should be solved by private companies or public sector research agencies (see Mazzucato 2013). Nevertheless there has been some development towards a more mission-oriented policy. Recent economic and innovation policy debate has emphasized that Finland should build its growth strategy around solving global challenges, or megatrends, such as the climate change and urbanization.

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LARS FREDRIK ANDERSSON

3

COUNTRY CHAPTER SWEDEN: THE SEARCH FOR THE DIGITAL DIVIDEND

INTRODUCTION

Innovation policy thinking evolved in the post-war period from the paradigmatic "Manhattan Project", where basic research provided the basis for applied research and development of new products and processes. In recent decades the concept of the "innovation system" has increasingly influenced the policy framework. The paradigm shift in economic and innovation thinking became apparent in innovation policy documents during the 1990s.

In Sweden, the innovation system approach implemented at the turn of the twenty-first century substantially changed the governance principles guiding industry, research and regional policy, while the funding structure within the innovation system underwent less dramatic changes. The government innovation budget (sum of support for research, industry and regional growth) has expanded gradually since the late 1990s. In relational terms, innovation expenditure increased from 2.5 to 4.3 per cent of the government budget (and from 0.8 to 0.9 per cent of GDP) between 1997 and 2014. Funding has increased from 25 to 36 billion SEK measured in fixed prices (2014 price level). Although expanding, government expenditure was less than half of the present business-sector R&D expenditure (85 billion SEK or 9 billion Euro in 2013). Taken together, business and government R&D spending increased from 107 billion SEK to 122 billion SEK between 1997 and 2014 (fixed prices). R&D as a proportion of GDP decreased from 4.3 to 3.4 per cent in the same period.

The structure of the innovation budget has clearly been biased towards basic research conducted at universities. In the late 1990s some 55 per cent of the total research and innovation budget went to basic research. During the 2000s, basic research gained an even stronger position. By 2014 its share was 64 per cent. Also sectoral research has become relatively more important, increasing from 10 to 13 per cent over the same period. The funding of the specialized industry innovation agency increased from 1.0 to 2.6 billion SEK during this period. In turn, governmental support for regional growth declined from 4.4 billion SEK in 1997 to 2.9 billion SEK in 2014. Other kinds of industrial support have also declined (from 3.8 to 3.0 billion SEK between 1997 and 2014). The funding of the innovation system saw less radical changes towards more applied R&D after the policy shift at the turn of the century. The innovation system approach has involved a gradual decrease in traditional regional and industry support, while peer-review-driven research has increased. Although specialized industry innovation support has grown in importance, it seems to be an island in an ocean of peer-review basic and applied university research. Although the role of basic peer-review-governed research in the innovation process is highlighted in policy documents, there have been few initiatives to play down the peer-review principle in favour of social and economic needs. In that sense, the innovation system approach developed from the late 1990s represented less of a deviation from the traditional way of thinking about research and technology. The linear way of thinking – that basic research will provide the basis for applied research and later development of new products and processes (Manhattan paradigm) – still prevails. Finding routes from curiosity-driven research to commercial application that meet social and economic demands is one of the major challenges for the Swedish innovation system.

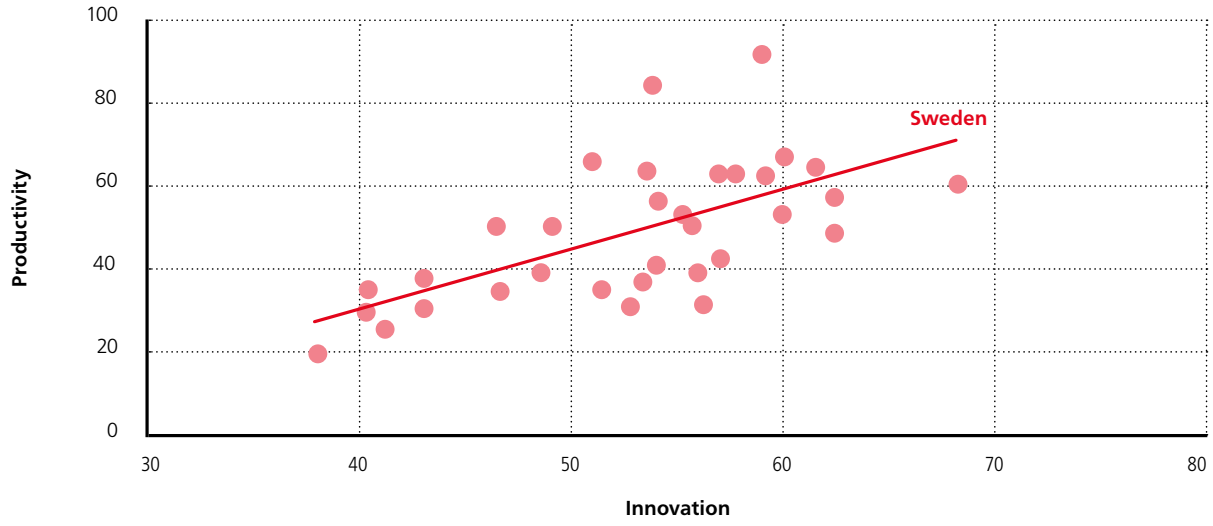
The impact of innovation system inputs on economic outputs is a key issue for the innovation policy. As shown in Figure 1, Sweden is a high-performer in most areas. Although there are a number of indicators on innovation output, most measures fail to effectively capture the output side of the economy. The number of peer-reviewed publications and patents is more related to innovation input than economic output. On the economic output side, the measures tend to be more growth-oriented and less related to innovation. Considering the deficits on both sides, a middle way is to review both sides.

One way of identifying the output of the innovation system is to measure overall technological progress in industry. In the Swedish corporate sector, overall technological progress measured as multifactor productivity (MFP) increased by 1 to 2 per cent annually from the late 1990s until 2001. During the ICT crisis in 2001, MFP declined by almost 1 per cent. After the ICT crisis, MFP increased again by 1–2 per cent annually. The financial crisis in 2007 put downward pressure on the demand side, causing MFP to decline substantially

Figure 1
Innovation input in Sweden relative to EU average

Source: EU Innovation Scoreboard.

Figure 2
Relationship between innovation and productivity in Sweden



Source: OECD statistics and Global Innovation Index.

due to low capacity utilization. After a deep downturn in 2009, demand recovered, which improved capacity utilization and MFP. In recent years MFP growth has been slow.

One of the key issues of the innovation system is how to transform the input of resources into new technologies in produces and processes. One way of comparing input with the output is to relate innovation scoring to productivity. The basic idea is that a high innovation score will produce higher productivity. Figure 2 shows the relationship between innovation and productivity for the OECD countries in 2014. It seems clear that there is a positive correlation, but also large variance across the OECD countries. However, how efficiently the innovation system is operating cannot explain all variation. A number of other factors could play a part. One reason could be differences in factor endowments. The country with the highest productivity level, Norway, is characterized by the abundance of oil and gas, making a significant contribution to the productivity level that is not innovation-driven.

Sweden is one of the countries with a relatively low return on innovation. In terms of performance, Sweden is ranked high in innovation (rank 2), but lower in terms of productivity (rank 11). Also, after excluding the top outliers in productivity scoring, Sweden performs less strongly than expected from the global innovation scoring.

INSTITUTIONAL STRUCTURE

The basis of innovation is curiosity-driven knowledge production conducted at universities, and diffused by educating students and, in applied form, by collaboration with industry or the public sector. More specialized R&D directed to social and economic needs is funded by Vinnova. Support to enhance business start-ups and regional growth is funded by NUTEK and venture funding agencies. Industry support, relating to the agenda of the innovation framework, includes development of investments, foreign trade and energy systems administered by Business Sweden, the Swedish Energy Agency and other related bodies. Further affiliated areas include tourism, agriculture and forestry.

According to its critics, the Swedish innovation system has failed to integrate basic and applied research with commercial innovations. University-based research was given its own sphere of influence with the researcher-controlled Swedish Research Council, which did not meet economic and social demands. The peer-review principle was applied in most agencies funding research based on sectoral relevance, and thereby making a clear division between curiosity-driven research at universities and the innovation R&D support guided by social and economic needs. This two-track system meant that Vinnova became clearly separated from peer-review-governed university research, and instead closer to industry policy agencies.

One of the major challenges for the Swedish innovation system is to find ways from basic research to innovations that meet social and economic needs. The division of research and applied R&D into different spheres of influence and governance creates a large gap in the Swedish innovation system. In an attempt to narrow the gap, the new government coalition (consisting of the Social Democratic Party and the Green Party) created an innovation council led by the Prime Minister in October 2014. Equipped with its own permanent administrative resources, it consists of representatives from the government, employers, unions and the research community. The innovation council may be seen as an attempt to create a more cooperative structure that will seek to merge common social and economic interests in the field of research and development. The council has set an ambitious goal to develop a new innovation strategy and revitalize innovation policy. The overriding goal is employment, achieving the lowest unemployment rate in the EU by 2020. In the short run, two of the first objectives are to improve venture capital funding and to introduce innovative public procurement.

A government inquiry into venture capital funding (finalized February 2015) submitted a number of proposals for making government financial support to SMEs more efficient. A new public fund will be established (by merging two previous funds) with the chief objective of co-financing early-stage venture capital investments in Swedish SMEs with high growth potential. However, the economic significance is small compared to private funding. To further enhance innovation in the public and private sectors the government will introduce innovation-driven public procurement. By using the substantial state and municipal budgets for procurements from the business sector (600–800 billion SEK), it is hoped that procurements will become a vehicle for business innovation. In line with that ambition a national agency for public procurement was established in 2014. The agency will work to support municipalities and public agencies by providing information on to how to enhance competitive and innovation-driven procurements.

The innovation council has discussed the impact of digitalization on the labour market and economy at large. Digitalization is understood as one of the major current driving forces for creative destruction and growth. A policy aimed at promoting productivity growth by enhancing digitalization in the private and public sectors will be an important field to develop in the innovation policy agenda. It is equally important to make education and the labour market work effectively to find ways from old to new work; to make sure that both the costs and gains of creative destruction are shared across society and not biased strongly by sector or social group.

The social aspects of the innovation system are of vital importance for gaining trust and acceptance in society at large. Innovation policy aimed at persuading elites, a sector or only part of the workforce faces the problem of being perceived as a policy only for the few. A policy that addresses social as well as technological and economic progress has recently been discussed in the OECD's innovation policymaking. In Sweden, the social aspects of innovation are currently narrowed down to support for specific projects empowering women and migrants. Support for social innovation is provided in projects helping the long-term unemployed to find ways to new work. The scope of social innovation in this narrow sense makes it a highly limited part of innovation policy.

CHALLENGES

Advocates of the innovation system approach emphasize the Schumpeterian creative destruction process in the economy; the creation of new work and the application of new technology to enhance growth and welfare. Focus is placed on how innovations emerge, diffuse and become utilized in the economy. In a vital innovation framework, the input of resources into the innovation system leads to high innovation intensity and technological progress such as (i) innovation of new products and services that meet social and economic needs, replace old work and create new employment and higher standards of living, and (ii) innovation in new production technologies that create a higher return on investments in terms of productivity growth.

From an economic perspective, one of the major challenges for the current innovation framework is to enhance productivity growth. Return on investments has remained weak in recent years. Although economic downturn following the financial crisis impacted negatively on capacity utilization in the industry, rising demand in recent years has not been followed by any strong upturn in total factor productivity, as seen historically after earlier economic crises. Technological progress has been slow, indicating weaker innovation intensity in the economy at large. If we compare the performance of the innovation system in relation to productivity, Sweden is underperforming. Based on a cross-section of OECD countries in 2014, the return on input in the innovation system is lower

than average. Based on the innovation scoring, the expected productivity level would be 5 to 10 per cent higher than observed. Closing the innovation-productivity gap is a key challenge for Swedish innovation policy.

The adaptation and diffusion of new technology is of vital importance for productivity growth. In recent years the role of the process of digitalization has been emphasized for productivity development in the corporate sector, for the efficient use of resources in the public sector, and for accessing new (or improved) utilities in the household sector. From an overall economic perspective, digitalization can be understood as a process where a growing share of the services provided by the capital stock is digital. Traditional services from the capital stock have been motivational power for industry processes, storing capacity in warehouses and ton-kilometres in transport system. In contrast digital services do provide computer power for calculations, controlling/managing capabilities for industry processes, and storing and network capacity for information in society at large.

In Sweden, the digitalization process originally started in the 1960s, but took off on a larger scale in the 1980s. The process of digitalization was strongest in the 1990s, and it has slowed in both relative and absolute terms in recent years. One of the drivers behind digitalization has been a decline in relative prices, making equipment-providing digital services cheaper than many other assets (e.g. prices of computers have decreased in relative terms). Most of the relative price decline was attained in the early 1990s, while the development for capital providing digital services has been less favourable in recent years (Statistics Sweden, National Accounts). The public sector is less digitalized than the corporate sector. The trend since the 1990s shows that digital capital services have developed less strongly than other services attributed to machinery and equipment. In recent years digitalization processes have been slow. The volume of digital services is today in fact less than 10 years ago.

The process towards digitalization is of major importance for productivity growth in the corporate sector and efficient use of resources in the public sector. Based on data from the last twenty years of digitalization of capital services, it can be shown that the digitalization process has stagnated in the Swedish economy. Digitalization is still progressing in the corporate sector, but less strongly than ten years ago. The public sector has underinvested in digital equipment, lowering the amount of digital services provided by ICT compared to ten years ago. To enhance the digitalization process in general, and in the public sector specifically, is a major challenge.

In recent years, a growing debate on the future of work has put forward the hypothesis of radical labour-saving technologies following ICT investment. Digitalization of work, implying a high substitution elasticity between ICT capital and labour input, is expected to make many white-collar jobs redundant (Frey and Osborne 2013). Digitalization may in that sense become a decisive force towards the destruction, but also creation of new work. Given a strong skill-bias, less-skilled workers will face a higher risk of unemployment and lower wages (Violante 2008). If so, the trend of growing skill-bias may be a key explanation for increasing wage differentials in the workforce and growing inequality between households.

The growing trend towards inequality fits with the neoliberal policy of cuts in taxes and opposition to redistribution measures. Since the early 1990s, inequality has been growing in the OECD in general. In Sweden, the Gini coefficient measuring inequality between households has increased from 24 to 33 over the last twenty years. If skill-biased technological change has been a decisive mechanism for increasing wage inequality, the future holds a major challenge in combating the trend towards greater inequality. Reconciling productivity-driven policy aimed at facilitating digitalization with a more inclusive and less unequal society is one of the most challenging tasks for innovation policy.

POLICY RECOMMENDATIONS

Reviewing the literature and statistics on input and outputs from the innovation system reveals three major challenges:

1 Closing the gap between innovation input and productivity;
2 Enhancing digitalization in the corporate sector in general and the public sector specifically;
3 Reducing income inequality among households.

It is necessary to improve cooperation on and coordination in innovation policy between government, research, and labour market organizations. Recent steps towards collaboration and unified agenda-setting points towards a more inclusive policy from all central actors in the innovation system. We recommend continuous close cooperation that provides results in policymaking. To improve the joint work, the innovation system approach needs both a supply-side and a demand-side orientation. While supply-side measures have been at the forefront, more demand-side measures are needed to further integrate the innovation system. Innovation-driven public procurement is a promising strategy. Given that 10 per cent of all public procurement will be innovation-driven, it will ultimately offer a greater stimulus for innovation than the current government R&D budget. Given the size of the budget, the impact of innovation-driven public consumption has the potential to be substantial. To work effectively, it will, however, demand a great deal of know-how within the procuring agencies if it is to go beyond product specifications and lowest-price requirements.

Investments to enhance demand-side driven innovation policy are a wider scope of concern. The need for investments is strong in both the public and the corporate sector. Especially on new ventures of capital as discussed later on. In order to improve investment management, we recommend a specific investment account. At present the budget includes consumption on fixed capital on the revenue side and gross fixed capital formation on the expenditure side. Applying a strict budget surplus target will place strong constraints on investments characterized by high initial cost and long-term revenue horizons. A life-cycle view of investment can be facilitated with a satellite investment account.

To enhance productivity development and efficient use of resources in the public sector, progressive investment in capital providing digital services is a necessity. We recommend that innovation policy should tackle the stagnation of digitalization

seen in the public sector and the slowdown in the corporate sector. Public investment in tangible ICT assets and intangible program and database assets may be improved by instituting a satellite investment account. Innovation-driven public procurement may support the digitalization strategy towards the corporate sector and the public-private cooperation further. Digitalization of the corporate sector is vital to enhance and improve the stagnating productivity growth seen in the last years. A policy aiming at supplying highly educated workers can support such a development.

The diffusion and application of capital providing digital services is a major force behind the destruction and creation of employment. To support positive developments, a flexible educational policy is needed to adapt to changes in skills needed to promote a further digitalization of the services provided from the stock of capital. A more flexible education policy will make it possible both for younger and older people to adapt to the new working conditions. Depending on the skill-distance between jobs destroyed and created, the time and cost of individual adaptation will differ. To reduce the individual short-term losses in this process, an inclusive social insurance system can more equally distribute the costs, and thereby distribute the gains of creative destruction more fairly and widely. We recommend a social insurance system whose premiums are not biased by occupation or sector. We believe that the universal social insurance system is an important social aspect of a successful innovation system.

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DANIEL BUHR

4

COUNTRY CHAPTER GERMANY: DIGITALIZATION AND THE NEED TO THINK BIG

INTRODUCTION

Although Germany came through the last economic crisis relatively well it is facing a series of major economic and societal challenges: the "Energiewende" (phasing out nuclear and fossil-fuel electricity generation), an ageing population with a declining share of young people, the rise of strong new economic competitors (in Asia) and growing economic and social inequality.

Digitalization offers great potential to tackle these challenges successfully. In Germany visions of digitalization (like "Industry 4.0") have to date largely involved technical solutions. Humans, however, play the lead role when it comes to the innovation process: as co-creators and producers, as users and innovators. The key is to understand digitalization as an interplay between technical and social innovations. According to the Center for Social Innovation at Stanford University a social innovation is a novel solution to a social problem that is more effective, efficient, sustainable, or just than current solutions. The value created accrues primarily to society rather than to private individuals. That requires a systematic innovation policy – not a policy in the mere sense of policymakers' activities, but one that includes companies, trade unions, civil society and academia. Only when these processes occur across domain boundaries and disciplines can we guarantee that technical innovations will contribute to social progress. Therefore innovation policy has to "think big" again (Mazzucato 2015) by following a concrete mission. One suggestion for such a mission could be to use digitalization for modernizing the welfare state in order to ensure that these innovations foster both economic and social progress.

INNOVATION IN GERMANY – FACTS AND FIGURES

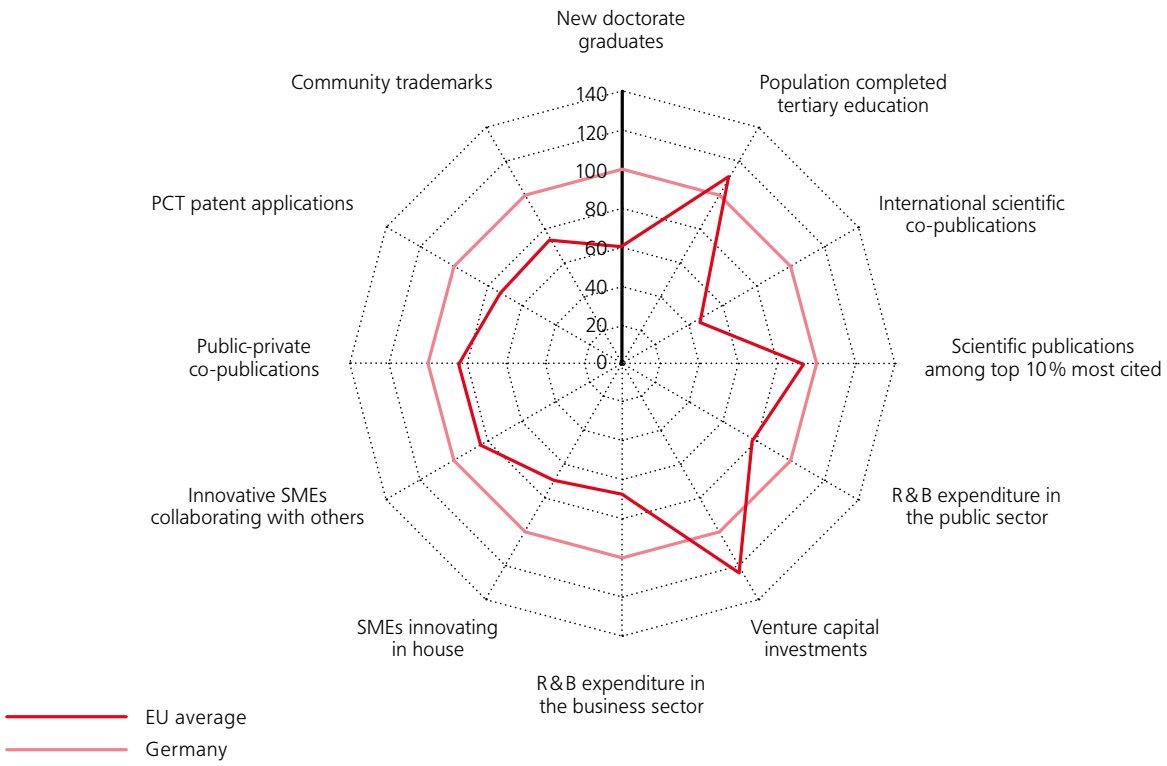
Even after the last global financial crash, Germany has increased its public and private expenditure on research and development – which has helped it to maintain a strong innovation capacity and a strong export performance. Germany's R&D intensity (expenditure on internal research and development in relation to GDP) is among the highest in the world, and in most of the global innovation rankings the country is listed among the leaders (WEF 2015, Innovation Union Scoreboard 2014).

Germany still has high labour productivity and a particular strength in business R&D. However, the innovation rate of SMEs varies greatly between sectors and has overall been declining since 2007. The strength of patenting is an indication of industrial leadership in several domains, most notably in medium and high-tech industries, including electrical and mechanical engineering, automobiles and chemicals as well as in environmental and energy technologies. Over the last decade, however, Germany has lost its strong market position in pharmaceuticals and optics. Furthermore, the availability of venture capital in Germany (0.19 per cent of GDP in 2012) remains below the EU average (0.29 per cent). In addition, especially the innovative and knowledge-intensive service sectors seem to have much more growth potential (European Commission 2014).

However, a central remaining weak point concerns Germany's "digitalization-readiness". Today only about one in five companies in Germany have a high degree of digitalization (PwC 2014). Obstacles to digitalization include poor broadband availability and slow internet connection speeds. While the average connection speeds in Sweden (16.1 Mbps) and Finland (14.0 Mbps) are among the fastest in the world, Germany's performance is much weaker (10.7 Mbps) according to the current State of the Internet Connectivity Report (Akamai 2015: 34). The ICT Development Index (IDI) published by the United Nations International Telecommunication Union shows Germany no higher than global rank 17 and regional (Europe) rank 11 (ITU 2014). The leading countries in the ICT Development Index are Denmark, South Korea and Sweden, Finland is ranked eighth. The IDI is based on several ICT indicators, grouped in three clusters: access, use and skills. One main weakness in Germany is the weak availability of broadband and the lack of e-government services, which aligns with a poor overall investment rate.

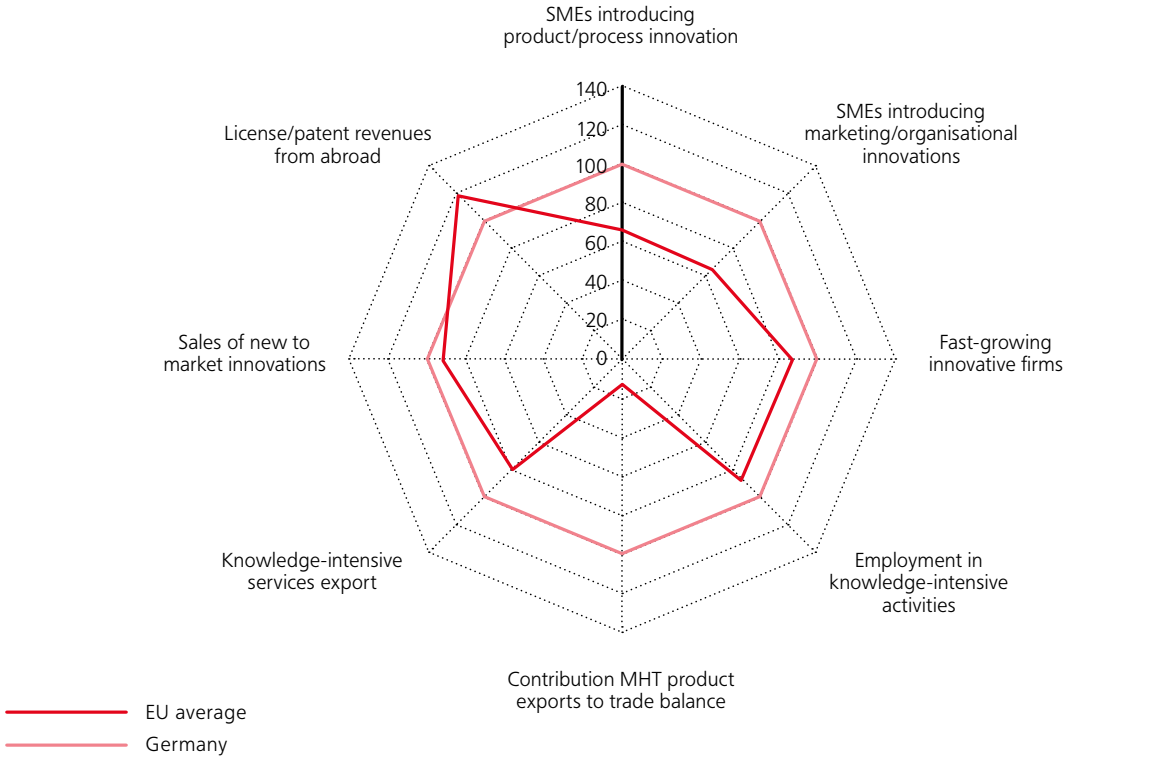
Germany's investment performance is currently quite weak in both the public and the private sector, and has declined

Figure 1
Innovation inputs: Germany



Source: European Commission: Innovation Union Scoreboard 2014.

Figure 2
Innovation outputs: Germany



Source: European Commission: Innovation Union Scoreboard 2014.

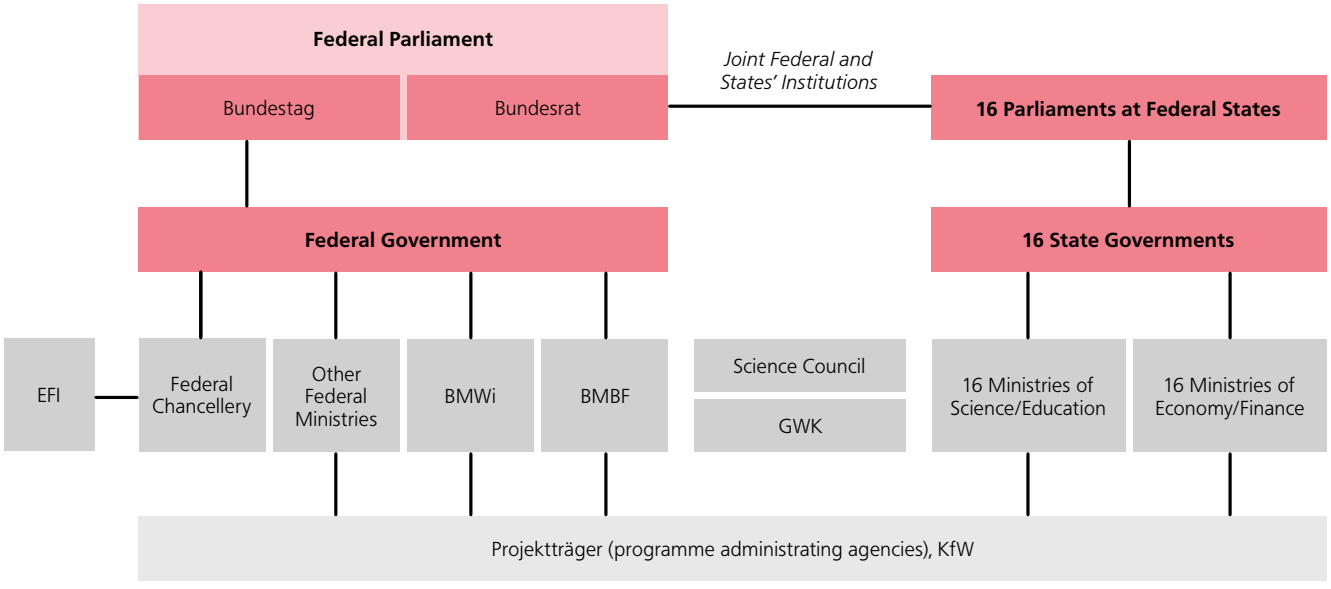
continuously over the past ten years. Local governments especially have accumulated enormous investment backlogs: the net fixed assets of municipalities in Germany declined by Euro 46 billion between 2003 and 2013. Estimates from the KfW Municipal Panel indicate that the municipal investment backlog currently totals Euro 118 billion (BMWi 2015). The federal government therefore set itself the goal of closing the gap between Germany's investment level and the OECD average.

INNOVATION POLICY IN GERMANY – INSTITUTIONAL SETTING

Innovation policy is a rather new phenomenon in Germany. Due to a long tradition of science and technology policy the first real attempt to broaden the perspective in order to upgrade these policies into a more systemic approach did not begin until the mid-1990s. In a coordinated effort the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of Economics and Energy (BMWi) developed a concept to foster small and medium-sized enterprises by supporting the whole innovation process – from invention (supply side) to diffusion (demand side).

Since then Germany's innovation policy has been – not least due to its federal structure – highly fragmented. At the federal level the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of Economics and Energy (BMWi) are mainly responsible for innovation policy. In addition, several other sectoral ministries are involved, as they maintain their own research institutes (Federal Ministry of Food and Agriculture; Federal Ministry for the Environment, Nature Conservation and Nuclear Safety; Federal Ministry of Health; Federal Ministry of Defense etc.). In 2015 the overall federal budget for innovation policy totalled in 14,901 million Euros. The German Bundestag has permanent committees (on education, research and technology assessment) that have to approve this budget.

Figure 3
Public Institutions in German Research and Innovation



Research Organisations by Institutional Funding:

Federal	Federal and Industry	Federal and States	States
FGL	AiF/IfG	DFG, FhG, HGF, MPC, WGL, AoS	HEIs, LGL

BMWi: Federal Ministry of Economics and Technology
BMBF: Federal Ministry of Education and Research
FhG: Fraunhofer Society
MPG: Max Planck Society
WGL: Leibniz Association
AoS: Academies of Siences
HEIs: Higher Education Institutions
FGL: Federal Government Research Organisations (Federal Agencies)

DFG: German Research Foundation
AiF: Association of Industrial Research Institutes
IfG: Institutes of Co-operative Industrial Research
KfW: KfW Banking Group – State-owned bank (80 % Federal Government, 20 % States)
GWK: Joint Science Conference of the Federal Government and the Federal States
LGL: Länder Government Research Organisations (State Agencies, other research institutions funded through State governments)
EFI: Expert Commission on Research and Innovation

Source: Rammer 2011.

In contrast to other countries, in Germany there is no strategic policy council to coordinate innovation policies. However, in order to improve at least the coordination of innovation policy throughout the above-mentioned federal ministries, the government in 2006 introduced the High-Tech Strategy (HTS), which was modified in 2010 and 2014. Unlike the innovation policies of the past, the HTS will not only promote individual emerging technologies but will also respond to society's need for sustainable solutions for clean energy, good and efficient health care, sustainable mobility, secure communications, and Germany's future competitiveness ("Industrie 4.0"). In sum HTS provides a more mission-oriented and demand-driven approach than past policies, and seeks to expand into a comprehensive interdepartmental innovation strategy that covers both technological and social innovations (OECD 2014).

CHALLENGES – INNOVATION POLICY IN THE AGE OF DIGITALIZATION

With its "Digital Agenda 2014–2017", the federal government has been attaching greater importance to the opportunities and challenges emerging from digital change (EFI 2015). But it is striking that many publications about digitalization today focus mainly on the Internet of Things, smart objects and smart factories. Thus far the "Industry 4.0" concept, for instance, is being explored primarily from a technical point of view (Buhr 2015). Increasing digitalization, however, will not only have an enormous impact on machines, factories and sectors, but on jobs and societies as well.

Increasing digitalization seems to be generating immense innovation potential. Technically, production can become faster and more resource-efficient. Organizationally, new modes of commercial organization could lead to new forms of employment and business models. Socially, the balance between career and family or old age and disability can find equilibrium (through the deployment of new services and intelligent assistance systems). These developments also entail enormous risks – at the individual as well as the societal level. Added flexibility may also mean further delimitation of work, acceleration of the intensity of work with more stress, and other new challenges to the work-life balance. There are other sensitive areas to keep in mind, such as data protection, privacy and security.

POLICY RECOMMENDATIONS – "THINK BIG"

However, digitalization offers great potential for modernizing the welfare state as well. Therefore it is important to understand digitalization as interplay between technical and social innovations. For that a systemic innovation policy is necessary. In the field of Industry 4.0, Germany could use the "Plattform Industrie 4.0" as a starting point. This network is operated by government, companies, business associations, academia, and trade unions. Together with the relevant partners and players, the government wants to use the newly expanded platform to actively tap the potential that digitalization offers for business. Nevertheless, we have to widen the focus – beyond the pure business perspective. Only when these processes occur across domain boundaries and disciplines can we guarantee that technical innovations will contribute to social progress. Here Germany has to rely more on social innovation, so that growing flexibility does provide chances for both employers and employees. Combining easy-to-use technical assistance systems with new social practices as well as improved dovetailing of various services could then open a window of opportunity for more social progress: participation and social integration, inclusive growth and better compatibility of career with family, caregiving, age and disability.

Social innovations occur in dialogue. The dialogue with society must therefore be an organic part of research and innovation; in turn, it can strengthen society's openness to technology and risk maturity. Taking innovation through participation seriously means doing more for the framework conditions, in addition to the technological developments and their integration into our life-worlds: areas like data protection, privacy and security, copyright, competition regulations and intellectual property rights. This requires early investigative and advisory measures regarding how legal framework parameters should be adapted to new technological developments, social practices and business models. This dialogue must also be promoted amongst companies. The course of internal dialogue has to cite the specific obligations of company and project management to ensure a participatory environment in which employee suggestions and advice can be incorporated. Motivation and promotion through targeted personnel development and the corresponding company culture are not-to-be underestimated stimuli for successful innovation processes. Thus those affected by digitalization (i.e. at the workplace) become its co-designers, who can then drive and accelerate its diffusion process into other societal areas.

In order to achieve this, German innovation policy has to "think big": "Finding a way for government to think big is not just about throwing public money at different activities; it requires visionary investments that do not simply fix markets, but actively shape and create them" (Mazzucato 2015: 148). Using the process of digitalization for modernizing the welfare state would be such a visionary investment as it provides a digital infrastructure that could be used by businesses as well as the whole of society, for education, health and well-being services.

Germany has to act. Policymakers should encourage both technical and social innovation, taking into account all the possibilities on the supply side – and on the demand side as well. A systemic understanding of innovation policy is required, one that includes strategy and coordinated implementation. Various actors must be brought into the process – companies, associations, trade unions and academia all have to take an active part. Only when the developments within and around digitalization result in social added value, when new technologies, regulations, services and organizations establish themselves in society and when these social practices prove to be "better for people", will we have recognized their potential and made it work. On the path toward these goals an active state is needed: A state that promotes and demands, that sets clear rules but also has the courage to "think big" and to invest in the future.

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CONCLUSION – ENVISIONING A PROGRESSIVE INNOVATION POLICY

THE COMMON FRAMEWORK

The focus of this concluding chapter is to crystallize the outlines of a progressive innovation policy that we regard as necessary to foster both technological and social innovation. Social innovation has been defined as a broader perspective on innovation processes beyond mere technological and industry-driven development towards a holistic approach that links technological improvements to social progress. We are not alone in addressing this kind of innovation framework. The European Commission, for instance, identifies social innovation as a key factor in its innovation and research programme "Horizon 2020":

"Social innovations are new ideas that meet social needs, create social relationships and form new collaborations. These innovations can be products, services or models addressing unmet needs more effectively." (European Commission 2015)

Germany is a good example of a country with an advanced technological industry simultaneously lacking sufficient diffusion of digitalization and innovations on a broader social scale. As highlighted in the introduction, innovation is then seen as merely a means to improve industrial and business performance and not as a way to foster social progress through, for example, tackling societal challenges or simply improving (digital) participation of workers in the workplace and citizens in general. Similar developments can be seen in Sweden and Finland. This is why we see it as imperative to initiate the discussion seeking a progressive innovation policy framework which both improves industrial and business performance and takes into account the social aspect of innovations. In the end, innovations not only affect people; they are made, used, affected by people – be they workers, self-employed or capital owners – in a social context.

This brings us to the central actors within innovation systems (which vary across countries, as mentioned in the foregoing chapters). Our starting point has been a focus on the role of the state in innovation systems to foster technological and social innovation processes because societal challenges and needs can and should only be met under a democratic and holistic perspective on the benefits and risks of innovation processes – for instance through increased digitalization of work – so that the whole of society and especially formerly marginalized social groups gain more than they lose. An active state acting within a progressive policy framework challenges the current hegemonic economic policy in Europe where austerity or at least balanced budgets are seen as indispensable.[1]

While there is a debate on the reindustrialization of post-industrial societies, the public sector and state investments in redistribution, infrastructure and the welfare state play a more marginalized role than in the traditional Keynesian eras. In our study, Finland and Sweden provide prime examples of this development, where centre-right governments have structured their economic policy around cutbacks in public investments, taxes and services in favour of private sector alternatives, which made especially blue-collar trade unions but also centre-left parties demand higher investment rates even at the price of deliberately increasing the state deficit.[2] Even the German government has consistently insisted on the need for an at least balanced state budget, consequently hampering large-scale investments by the state. The point is that even if an increased state deficit is not necessarily a prerequisite for a progressive innovation policy, the state has to be perceived as a highly active participant in promoting and fostering the development, implementation and diffusion of technological and social innovations. Looking at the social aspect of innovations, these processes cannot be the sole responsibility or interest of business and civil society. Innovative public procurement is one example of a key factor in progressive innovation policies in which the state plays a dominant role. However, before we outline policy recommendations based upon these insights, let us take a brief look at the three case studies to frame our understanding with actual developments in innovation policies and digitalization in Germany, Sweden and Finland.

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1 See for example Scocco (forthcoming 2016), The Powerless Left.

2 For Sweden see for example Järliden Bergström, Jonsson and de Toro (2015): Vägen till full sysselsättning och rättvisare löner (Stockholm 2015); for Finland see Antti Alaja's text in this study.

FROM HIGH-TECH EXPORT INDUSTRY TO SOCIAL DIFFUSION OF INNOVATIONS – THE CASE STUDIES

Considering both the innovation input and output and the way in which innovation is institutionalized, the three countries do not differ that greatly. All three countries have a tradition of high R&D-spending especially targeted at (medium and) high-tech export industries (for example Nokia in Finland). However, there are considerable differences in terms of developments during the past few years.

Finland, for example, focuses mainly on economic competitiveness through high-value products and services, while overall spending on R&D, both public and private, has decreased in recent years. With the Finnish economic crisis, exports in these sectors have declined leaving Finland lagging behind in terms of innovations in knowledge-intensive sectors or the introduction of marketing and organizational innovations. In Sweden, focus has shifted since the late 1990s from regional and industry-specific support and R&D spending concerned with economic and social needs in favour of basic research at universities. Sweden faces a challenge in the diffusion of research advances into new products and processes. Productivity is low in comparison to input in the innovation system. Especially during the last decade the return on innovation in terms of multifactor productivity has been low. While there is an incentive to coordinate innovation policies and processes at the national level through a new innovation council headed by the prime minister, little has been done in the way of an overall attempt to foster innovations concerned with broader economic and social needs.

In Germany innovation policies have long been limited to high-tech export industries, which is still the case. However, one can detect a growing debate on a broader concept of innovation policies especially concerned with digitalization and its implications for society as a whole and specific social needs. This gives us a first glance at the central issue of this study: the idea of an innovation policy framework fostering both technological and social innovations. It has been mentioned that the role of the state in developing, implementing and diffusing these innovations is crucial, especially if innovations are to benefit the majority in society and respond to social needs. The way in which social innovation is understood and embraced as an issue differs between Finland, Sweden and Germany, as so does the role of the state in innovation processes. Finland was early in coordinating innovation policies at the national level, implementing national agencies such as Tekes and Sitra and complementing them with an innovation council headed by the prime minister.

In contrast to Finland, Sweden's government policy has long been focused on basic research, leaving funding and development of innovation processes linked to specific economic and social needs to its agency Vinnova. As a result basic research is disconnected from other innovation processes. In Germany, a broad national coordination of innovation policies was been lacking until the first so-called High-Tech Strategy in 2010. Since then it has been developed further, as a more comprehensive, interdepartmental innovation strategy. However, innovation policy in Germany is still heavily fragmented both vertically and horizontally. With a growing debate on digitalization and its effects on society and labour relations, the national "Plattform Industrie 4.0" has been established, consisting of public- and private-sector representatives as well as trade unions. Also, while the concept of social innovations is mostly absent in Finland and Sweden, the possibility and necessity to view innovation processes not only as a means to boost economic growth but as an opportunity to tackle societal challenges is becoming a growing part in the debate on innovation and digitalization in Germany.

At the same time, both Antti Alaja and Lars-Fredrik Andersson highlight the need to broaden the innovation policy debate towards an equal sharing of the costs and benefits of innovation processes across society, and towards viewing innovations as possible solutions for both economic and social problems. Especially in Finland where the state under the new centre-right government is starting to focus on spending cuts (including R&D) and austerity measures making large-scale public investments difficult, there is a need to highlight the importance of state-led innovation policies and, naturally, investments to overcome economic and social crisis. Table 1 summarizes national policy recommendations for the three countries.

Again, national innovation policies are not enough for countries incorporated into the European Union and the (digital) single market. This chapter therefore now turns to policy recommendations aimed at the European level to safeguard innovation processes from both an economic and a social perspective.

ENVISIONING A PROGRESSIVE INNOVATION POLICY – A EUROPEAN TASK

Based upon the experiences and performance of innovation policies in Germany, Sweden and Finland, the following policy recommendations are seen as imperative to channel innovation processes in a broader sense so that the majority of society can reap the profits of technological and social developments – instead of society or the state taking the risks while small groups in society benefit and potentials associated with for example increasing digitalization of work and everyday life are not fully utilized.

First of all, it seems advisable to develop systemic solutions on a European level, in order to occupy a stronger position at a global level. The EU could for instance evolve into a lead market for Industry 4.0. Europe (still) has a stronger industrial marketplace than the United States. Europe has nearly 800 million inhabitants – and the 28 EU member-states make up a population of half a billion. Therefore, Europe should reflect on its strengths – but lose no time in picking up the pace to establish dominance in the most important areas at an early stage. Economic integration remains one of Europe's major strengths, linked directly to the size of the market – a huge advantage when it comes to setting standards. Here, in this European lead market for Industry 4.0, successful providers encounter critical users and differing needs. It is not about reinvention, but cooperation in order to learn from one another and develop common standards – with regard to data privacy, data safety and security (for example European cloud infra-

Table 1
Policy recommendations on the national level

Germany	Sweden	Finland
Enhance digitalization and automatization by increasing public and private investment in order to improve productivity growth.	Enhance digitalization and automatization by increasing public and private investment in order to improve productivity growth.	Promoting technology and innovation should again become a priority for Finnish policy-makers. Both the last government and the current one have made significant cut in spending on education and R&D.
Make better use of the demand side through innovative public procurement.	Reduce the innovation gap: improve return on innovation input in terms of productivity growth.	Policymakers should actively promote innovative public procurement in order to provide reference markets for Finnish start-ups and to make the public sector more efficient.
Better coordination of innovation policies.	Mitigate the social and economic consequences of rapid structural change through greater spending on education and social insurance.	Finnish innovation policy has been criticized for focusing solely on improving the competitiveness of Finnish companies. Innovation policy could be more mission-oriented, designed to solve social challenges such as the climate change and urbanization.
		Since the 1990s there have been unrealistic expectations that universities could commercialise their research or even help to start spinoff companies. While many of these activities to commercialise public research make sense, it should be emphasised that universities promote innovation best when researchers perform high-quality research and teaching.

structures, digital internal markets and European legal frameworks). Unfortunately, these opportunities are still far too often neglected, as the economic actors follow their own short-term national interests. Moreover, many EU policies still permit considerable national discretion (Enderlein/Pisani-Ferry 2014: 41 ff.). This leads to fragmentation and small-time plays that miss the big win. Common standards, norms and rules – technical as well as social – could make a major contribution to more positive integration and cohesion, and to more growth and social progress.

INNOVATION AS SOCIAL PROGRESS

Innovation processes should be viewed as leading to social progress. It therefore does not make sense to focus merely on national policies. Instead we must engage in a debate on the European level, as the individual member states' societies are so interlinked through the single market and therefore dependent on social standards, possibilities and limitations in other member states. Modernizing societies through innovation should then mean fostering not only economic growth but also social progress, which would require a revitalization of a European social model. Looking at the EU's ambition for a digital single market, it becomes clear that this is discussed predominantly in terms of economic and technological performance rather than linking it to growing citizens' or workers' participation or tackling social inequality.

This paper therefore argues for highlighting the implementation of a European social model as imperative to safeguard innovation processes within a progressive framework. Social standards, as in socially responsible regulations, are then not disadvantages for economic growth but the foundation of innovative societies in which both producers and users of innovations can benefit. Here we can learn from the country studies in this publication. Germany, Finland and Sweden are prime examples of countries that have traditionally based their economic performance on high social standards. The process of setting common social standards linked to innovation processes and digitalization is then a task not only of national governments but also of trade unions and other civic organisations. Here, the German "Plattform Industrie 4.0" and the Swedish innovation council can serve as blueprints for coordinating innovation policies across actors in society (government, agencies, business sector, trade unions etc.).

REDEFINING THE ROLE OF THE STATE

As we said in the beginning, a progressive innovation policy concerned with both technological and social progress needs an active state providing central infrastructure, social and technical standards, common data safety and security, intellectual property rights, and strong investment in research and education. This means that the overall economic policy in the European Union and its member states has to be

rethought in terms of enabling an active innovation policy linked to social progress. What we mean is basically an understanding of the necessity for more investment, especially concerning digital infrastructure in order to modernize the economy and the welfare state. Moreover, there is a need to go from strict monetary and austerity policies to a more active state investing in innovation, research and education, to name a few areas. Mazzucato, for example, has shown that public investments have always been the backbone of successful innovation processes and, more often than not, social progress (Mazzucato 2015).

Looking at digital infrastructure, it is clearly a European task to ensure equal opportunities to connect and thereby develop innovative processes across European member states. A European programme for broadband on a European scale could be a first step in that direction. This is also important in relation to the potential risks of a digital gap between member states making it difficult to ensure the diffusion and equal distribution of benefits linked to innovations (for example a digital single market) across Europe. If the European Union is meant to be a project of international solidarity and common economic and social progress, innovative processes for social progress cannot be restricted to a handful of nation-states.

TRANSNATIONAL LEARNING

A policy debate on the European level also means learning from local experiences. Highly innovative regions in various countries provide better welfare to their citizens, better services and greater opportunities to foster innovative processes. These experiences therefore need to be incorporated into a dialogue at the European level. Bringing local processes closer together and linking them to a common European policy framework would improve the possibilities for implementation and diffusion beyond these already highly innovative regions.

INNOVATIVE PUBLIC PROCUREMENT

Another central policy recommendation for a progressive innovation framework would be to consider innovative public procurement. This would create and boost reference markets for specific sectors and enable more risk-taking in public administration. Here, the state would take an active part in innovation processes alongside the private business sector. This could help to foster innovative processes in the public sector linked to specific social needs.

The demand for innovation-driven public procurements is significant. In Sweden, public procurements make up a substantial part of the public budget (60–80 billion SEK). According to an OECD study (2011), the volume of public procurement is 17 per cent of GDP in Swedish, 14 per cent in Finland and 13 per cent in Germany. In Finland there are already examples of successful innovative public procurement in a couple of cities and municipalities. Oulu introduced a digital lock system through innovative procurement, and Tampere and Jyväskylä have been also been forerunners in this respect. The biggest obstacle to innovative public procurement is a culture that disapproves of risk-taking by public organisations. Secondly, not all civil servants have the know-how to launch the process of innovative public procurement. Therefore a national organisation should be established to encourage municipalities to press ahead with innovative public procurement.

CONCLUSION

What this study proposes is a highly proactive approach to promoting, developing and diffusing innovations. With the focus on the social aspect of innovations and the consequences and possibilities for greater participation, less social inequality and better social services, an active and innovative state policy presupposes a redefinition of the role of the state in economic policy, a European coordination of digitalization and social standards, transnational learning on the European level, and an evaluation of innovative public procurement. Most of all, a debate about the social relevance of innovations is urgently needed to counteract a narrow focus on technological development and benefits for high-tech industries. This study is a first step towards engaging in a transnational discussion and looking at transnational approaches to a progressive innovation policy framework.

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