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Innovation systems and policy: A tale of three countries

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Abstract

Nordic policy makers have long been aware of the fact that prosperity requires more than just, say, well-functioning labor markets and/or generous social and educational policies. It also requires that the capabilities of the labor force are put to productive use in a way that enhances the productivity of the nation and hence the returns for the stakeholders. Nordic policy makers have therefore for a long time experimented with various policy instruments supporting productivity growth. Over the years different labels have been attached to such policy experiments (science, technology, industry policy etc.), but more recently the term innovation policy has become more widely used, and this practice is also adopted here. The paper provides an account of how innovation policies have evolved in three Nordic countries (Sweden, Norway and Finland) and considers the possible lessons from what has been done. The discussion is informed by the literature on national innovation systems (introduced in the second section of the paper).

Keywords : National innovation system, innovation policy, Nordic countries

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1. Introduction

The Nordic countries are among the richest in Europe and globally. They are also known for having a more equal distribution of income than elsewhere, for highly organized, regulated and inclusive labor markets, for universal welfare states and for well-developed and free education systems. There is even talk of a special “Nordic model”, although detailed studies indicate that there may be larger economic, political and institutional differences between the Nordic countries than the notion of a common model might suggest (Mjøset 1987, 2015). While the Nordic experiences with labor markets, income distribution and provision of welfare have been widely studied, their experiments with innovation policy broadly defined, i.e., policies affecting innovation and diffusion of technology in an economy (and hence its productivity), have received far less attention. This is unfortunate because it arguably has been an important element in the Nordic policy mix. In fact Nordic policy makers have long been aware of the fact that prosperity also requires that the capabilities of the labor force are put to productive use in a way that enhances the nation’s productivity and hence also the returns for the stakeholders. The policy makers have therefore for a long time experimented with policy instruments supporting innovation-diffusion and productivity growth.

Over the years different labels have been attached to such policy experiments (science, technology, industrial policy etc.), but more recently the term innovation policy has become widely adopted for such policies. The change in terminology reflects the spread of a new perspective on economic development, the national innovation approach,¹ focusing in particular on the roles played by innovation and diffusion. The next section briefly summarizes some main aspects of the literature on national systems of innovation and considers the implications for the study of innovation policy. Section 3 discusses the evolution of innovation systems and policy in three Nordic countries, Sweden; Finland; and Norway, from this perspective. The final section sums up the study and reflects on the lessons.

¹ Scholars from the Nordic area (see e.g., Lundvall 1992, Edquist 1997, 2004) have been very active in developing and promoting this perspective, sometimes in direct interaction with policy makers (Carlsson et al (2010).

2. Economic development, innovation systems and policy: A brief overview of some major issues

The view that economic development depends on innovation is now commonly accepted. But it hasn't always been like that. The dominating strand of economic thinking during the last hundred years or so, so-called neoclassical economics, basically ignored innovation and focused instead on increases in capital, labor and land. However, this view received a blow with the first attempts to develop formal growth models based on the neoclassical perspective (Solow 1956) and research the empirical implications. The research showed that only a tiny fraction of the increase in GDP per capita in developed countries could be explained by factor accumulation (Abramovitz 1956, Solow 1957). It was concluded that the lion's share of economic growth had to be accounted for by technological progress, the sources of which were assumed to be found mainly in science. This brought increasing attention to the finance of scientific activities, which was believed to be constrained by the failure of firms to appropriate the returns to such investments (Arrow 1962). Although the concern for such "market failures", and the possible role that the public sector can play in financing science (including supporting firms' own investments in science), continue to play an important role in the shaping of public policy, it soon became clear that there is more to innovation than its scientific underpinnings (see, e.g., Freeman 1974), and that traditional economic theory was ill equipped when it came to understanding the issue.

This led, from the 1960s onwards, to a gradual revival of interest in the work of Joseph Schumpeter, who during the first half of the previous century had developed an original theory of economic development, emphasizing innovation as its driving force (Schumpeter 1934).² Schumpeter drew a sharp distinction between invention, as the first occurrence of new idea of how to do things, and innovation as the first attempt to do so in practice. Far from being an innocent step the latter is according to Schumpeter beset with difficulties of various sorts, which require special agents, what he called entrepreneurs, and organizations (e.g., private firms) to be successfully overcome. However, although Schumpeter clearly aimed at a social theory of innovation, he focused mainly on the role of individual entrepreneurs and their (in his view) inert surroundings. The possibility that external environment could also be a resource for firms in their innovation activities received far less attention from him. Nevertheless, Schumpeter also provided us with a definition of innovation as a "new combination" of existing sources of knowledge,

² See Fagerberg (2003) for more on the perspectives of Schumpeter and his followers.

capabilities and resources, not all of which may reside within a firm. In fact, in many cases, knowledge, capabilities and the like must be acquired from “external” actors, such as other firms, research laboratories or universities, and how to succeed in doing so has been a recurrent theme in subsequent research (Cohen and Levinthal 1990, Chesbrough 2003). Hence, although innovation primarily occurs in firms, it is at the same time an interactive process, in which many different social agents within the public and private sectors may be involved (Lundvall 1988, 1992, van de Ven 1999).

The increasing focus on the interactive nature of innovation led around 1990 to the development of a system approach to innovation (Freeman 1987, Lundvall 1992, Nelson 1993), which particularly emphasised the interactions between the various actors, organizations and institutions in the system for its (innovation) performance.³ Although the approach can be (and has been) applied at different levels of aggregation (Edquist 2004), the earliest and arguably most influential contributions in this research tradition focused on the national level, hence the term ‘national innovation system’(NIS). A national system of innovation is formed over a long period of time through interaction – or coevolution - between its economic system (major industries, firms etc.) and its political and institutional system (Fagerberg et al. 2009a,b), and may – once established – be remarkably persistent. The approach has been applied in studies of a number of different countries (see e.g., Edquist and Hommen 2008). It quickly attracted the interest of policymakers and, not the least, the OECD, which did much to propagate the approach in the decades that followed its creation (OECD 1997, 1999, 2002). The OECD has also adopted it in evaluations of the national innovation system and supporting policies in for example Norway and Sweden (OECD 2008, 2013).

³ It was the British innovation researcher Christopher Freeman who (as early as around 1970 if not earlier) started to use the term “social system” in studies of invention, innovation and diffusion of technology, which he regarded as strongly interdependent processes. See Fagerberg et al (2011) for more on Freeman’s contributions.

Figure 1. The frequency of the innovation-policy and innovation-system terms according to Google.

Source: <https://books.google.com/ngrams>

Figure 1 illustrates the increasing popularity of the terms innovation system and innovation policy from the 1990s onwards. As the figure shows the takeoff came earlier for innovation system than innovation policy, indicating that the spread of the former may have been instrumental in creating interest for the latter. Innovation policy may be defined broadly as all policies that have an impact on innovation (Edquist 2004), or more narrowly as policies (or policy instruments) created with the intent to affect innovation. But if we are interested in the impacts on innovation, the former, broader definition appears most appropriate. What we recognize as innovation policy may also depend on what we mean with innovation, e.g., is it limited to, say, highly novel products and processes or does it extend to the entire process from the emergence of new ideas to the diffusion of innovations in the social and economic system? Arguably, what mainly matters for the economy is not the occurrence of new ideas but their exploitation, so from this perspective the latter, broader definition of innovation makes most sense. One of the early proponents of the innovation policy term, Professor Roy Rothwell at the Science Policy Research Unit (SPRU) at the University of Sussex in the UK, gave the following description of it: “Innovation policy is essentially a fusion of science and technology policy (...) and industrial policy” (Rothwell 1982, p. 3). Hence, as Rothwell points out, the term innovation policy will include many policy instruments that in earlier times were carried out under other labels.

The innovation system approach, and its emphasis on the interactive nature of innovation, led to the development of innovation policy instruments – applied in many countries - aiming at bringing different

parts of the system together in the pursuit of innovation. Examples include incentives for firms to cooperate with public research organisations (and vice versa), support to innovation (or technology) platforms (bringing firms and other organisations working in the same domain together) and cluster-policies (often with a regional focus). Equipping the actors with the required capabilities for profiting from such interaction also became a central goal for policy. Another important aspect highlighted by the innovation systems literature concerns the strong complementarities that commonly exist between the different parts of an innovation system and associated policy instruments. If, in a dynamic system, one critical, complementary factor (say, knowledge, finance or demand) is lacking or fails to progress, this may block or slow down the growth of the entire system. This led to an increased emphasis on identifying factors that hamper the dynamics of the system, so-called “blocking” factors (Bergek et al. 2008), and on policy instruments that may relieve the detrimental effects of such factors on innovation-diffusion and growth.

The complementary nature of the factors influencing innovation also suggests that the impact of a specific policy instrument cannot be assessed in isolation, and that a holistic perspective on policy therefore is required (see e.g., Boekholt 2010). However, this “holism” may be quite challenging in practice. For example, calculating the total effects of a broad set of interacting policies (processes) requires a larger (and more sophisticated) analytical capacity in public administration than what has been common. Moreover, it implies that policy makers from different domains (ministries, sectors, administrative levels etc.) have to work together and coordinate their activities (policies), which is known to be difficult to achieve as it tends to conflict with the established structures, practices and routines in public administration (Flanagan et al. 2011). Successfully applying the innovation system approach to policy may therefore require the development of new forms of governance (Smits and Kuhlman 2004) facilitating the creation, adaptation and coordination of policy (Braun 2008).

3. Innovation policy in the Nordic region

This section analyses the evolution of innovation policies – or policies affecting innovation - in three Nordic countries based on the existing literature on the subject. In each case we start by analyzing the origins of the innovation system, with a particular focus on the interaction between leading sectors of the economy, providers of skills and knowledge, and policy. We then analyze important policy challenges that have emerged, the resulting changes in policy and the organizations associated with it and, finally,

the current policy stance. To conduct the analysis we searched for comprehensive studies of the Nordic innovation systems and/or innovation policy such as, in the case of Sweden, the very thorough report on the Swedish innovation system produced by the OECD in 2013 (OECD 2013). A similar study is available for Norway as well (OECD 2008). We also benefitted from consulting the analysis of the evolution of the Norwegian innovation system in Fagerberg et al (2009a,b) and the extensive discussion of Norwegian innovation policy in Spilling (2010). In the Finnish case the discussion is based on a thorough evaluation (in two volumes) by a panel of experts (Evaluation 2009) and a more recent study by Miettinen (2013). The above studies were supplemented with information from other sources, published or available through the web, to highlight particular issues.

Sweden

As the other Nordic countries Sweden largely missed “the first industrial revolution”. Its major export sectors, e.g., forestry and mining, continued to be based on exploitation of natural resources. In contrast, Swedish firms were quick to exploit the opportunities offered by “the second industrial revolution” around the turn of the twentieth century, based on innovations in production, distribution and use of electricity and oil (Edquist and Lundvall 1993). A number of firms, some of which (ABB and Ericsson for example) eventually grew very large and became global players, emerged during this period in industries such as telecommunications, office machinery, electrical domestic equipment and transport equipment. Subsequently an important pharmaceutical industry also materialized. A knowledge infrastructure adapted to the needs of these industries gradually evolved, and engineering education and research expanded rapidly. Sweden’s first technical university (KTH, The Royal Institute of Technology), growing out of an engineering college in Stockholm dating back to 1827, was created in 1876 (a special department for electrical engineering appeared in 1901). Another important environment for engineering education and research was Chalmers Institute of Technology in Gothenburg (established in 1829 but only acquiring university status in 1937).

Swedish innovation policy during the “golden age” of “the Swedish model”

With hindsight the decades preceding the slump in the global economy in the mid-1970s may be seen as a “golden age” for the Swedish economy. Industrially the country was far ahead of its Nordic neighbors and arguably among the world leaders in many industrial areas. A characteristic feature was a very high level of R&D investments as a share of GDP, one of the highest in the world (Figure 2). As in other

countries with high-R&D intensities the main source of this was investments made by private firms, particularly a number of large, internationalized companies. Nevertheless, public R&D investments, although small compared to those of the private sector, were also high by international standards, reflecting the broad consensus in Swedish society about an R&D-based growth path. These public R&D investments were concentrated in the university sector, which hence became pretty large. Thus, two important pillars of the Swedish innovation system were a cluster of R&D-intensive, large firms and a strong university sector that served these firms with highly skilled labor and other services. The third pillar of the Swedish system, to be discussed below, was the state's proactive role in promoting innovation in selected areas.

Figure 2. R&D as a share of GDP, average 2007-2011 (total and by funding sector)

Source: Calculations based on Eurostat (<http://ec.europa.eu/eurostat/>), downloaded on January 1, 2014

“The Swedish model” is often used as a short-hand for the close cooperation between big business, labor unions and the state that influenced Swedish politics and the social and economic development of the country from the 1930s onwards. A central goal for this cooperation was to increase productivity so that both healthy profits and increasing welfare for the population could be achieved. Technological progress, naturally, was seen as crucial for realizing this goal, and quickly attracted the attention of policy makers. A technical research council (TFR), the first research council in Sweden, was set up in 1942. It was succeeded in 1968 by STU, literally the “board for technological development” and later, in 1991, by NUTEK (the directorate for industrial and technological change). A characteristic feature of Swedish science, technology and innovation policy was a strong emphasis on supporting university R&D, particularly in areas which policy-makers considered to be of high political and economic importance, such as nuclear energy or telecommunications. In addition, a major effort was made to engage the large, technologically advanced Swedish firms in (infrastructural) projects initiated by the state, of which is the cooperation between the firm Ericsson and the Swedish telecommunication agency (Televerket) about the developments of digital switches (the AXE system) may serve as an example. Hence, during this period, the state played a quite proactive role in fostering innovation and the technological capabilities underpinning it.

Economic frustrations and changes in the policy stance

The rapid economic growth during the “golden age” came to a halt towards the end of the 1970s and in the decades that followed Swedish economic development was characterized by slow growth, structural problems and, from the early 1990s onward (when Sweden underwent a financial crisis), relatively high unemployment. “The Swedish Model”, which had been seen as big asset by many both in Sweden and elsewhere, was now generally regarded as a liability. The view that direct government involvement in industry of the type practiced in Sweden, “picking winners” as it was sometimes called, was counterproductive gained currency. Hence, the type of innovation policy pioneered in Sweden – characterized by extensive public-private interaction – increasingly became out of tune with the neo-liberal rhetoric that dominated politics all over the western world around the turn of century. The privatization of public infrastructure providers, such as Televerket, and new competition legislation mandated by the European Union’s “internal market”, may also have made the innovation model based on public-private interaction pioneered in Sweden more difficult to pursue.

Swedish innovation policy, from the 1990s onwards, gradually moved away from the strong sectoral focus which had characterized it in earlier decades. However, the strong emphasis on universities, and

their R&D capabilities, as crucial inputs to firm-level innovation was retained or even strengthened. Policy aimed at supporting excellence in university R&D and strengthening the links between the university sector and private companies, often through various types of “centers” (in universities). The focus on linkages between the different actors in the system was of course consistent with the “national systems of innovation” approach which gained currency among both scholars and policy-makers during the 1990s, so much in fact that it gave name to VINNOVA, the Swedish Governmental Agency for Innovation Systems, which was established in 2001 as a new framework for some of NUTEK’s previous activities. In addition to supporting excellence in university R&D and interaction between firms and universities VINNOVA also places emphasis on supporting innovation activities in small- and medium sized enterprises (SMEs), which receives about half of VINNOVA’s funding. A more recent addition to the Swedish innovation policy flora also supporting small firms and entrepreneurship is “Tillväxtverket” - The Swedish Agency for Economic and Regional Growth – established in 2009. As the name suggests this agency, which also grew out of NUTEK, distinguishes itself from VINNOVA by having a clear regional focus.

Challenges for governance

As noted by the OECD (2013) the Swedish Innovation Policy landscape today contains many public actors, from rather large to quite small, that in various ways influence innovation. In addition to the innovation-promoting agencies mentioned above, there exist a number of research-supporting bodies, the biggest of which is VR (literally the Science council) with a budget twice that of VINNOVA. VR covers all areas of science, and the funding mainly goes to the largest and most prestigious universities in Sweden. The smaller, more recently established universities can also seek R&D support from a special organization created for this purpose: the KKS (the Knowledge Foundation). In addition, there are a number of other smaller funding agencies, each with its own specialized profile, from, say, environmental/sustainability issues via health to working life and social issues.

The fact that there are so many public organizations in this area – according to the OECD Sweden outperforms all comparable countries in this respect by a wide margin (OECD 2013)– reflects that the Swedish governance system in this area is indeed quite fragmented. Several ministries are involved, the two most important being the Ministry for Education and Research and the Ministry of Enterprise, Energy and Communication. While the former has the main research council (VR) within its portfolio, the latter is responsible for VINNOVA. In addition the Ministry for Health and Social Affairs and the Ministry of the Environment both have their own research funding bodies. Moreover, the focus of most of the

ministries and the organizations within their responsibility tend to be squarely on research, which although a vital part of a national innovation system, is not identical with innovation. The weak emphasis on innovation – and innovation policy – at the ministerial level is also noted by the OECD which observes that not even the ministry responsible for VINNOVA mentions innovation as one of its (nine) key responsibilities (OECD 2013, p.224) .

The fragmented nature of governance and policy implementation in this area surfaces from time to time as a challenge for policy-makers, and there have been some attempts to develop practices or policy instruments that overcome the problem. One such instrument is the Research and Innovation Bill to Parliament, which is coordinated by the Ministry for Education and Research. The focus here, however, is mainly on providing broad guidelines for public investments in research, how these should be spent (priorities) and how the results may be exploited so that the benefits to society from these investment are maximized (e.g., commercialization). In recent years, increasing investments in public R&D has been a priority of the government, reflecting its support for the R&D-driven growth path that has been a characteristic feature of the Swedish economy for a long time. The bill for the period 2013-2016 in addition gives priority to research in the life sciences, arguably a policy response to the sharp reduction of private R&D in Sweden in this field in recent years, following a series of foreign takeovers of large Swedish pharmaceuticals firms.

Another attempt to provide a better coordination of policy in this area is the “national innovation strategy” coordinated by The Ministry of Enterprise, Energy and Communications. The first attempt, published in 2004, advocated a broad approach to innovation policy and called for cooperation between major stakeholders in this area in the creation of a strategy for the future. To implement this idea an “Innovation Policy Council” was created, however, after a short while the idea was abandoned.⁴ A second attempt by the government to formulate such a strategy – termed “The Swedish Innovation Strategy” – surfaced in 2012. As the first version it advocates a broad approach to innovation policy and pays homage to the grand societal challenges facing society such as climate change. However, the strategy is unclear with respect to how this should be implemented in practice.

⁴ Sweden recently had a change of government, and with the new government an innovation council, chaired by the prime minister, reappeared as an advisory body primarily intended to facilitate interaction between government and industry. See <http://www.regeringen.se/regeringens-politik/innovationsradet/innovationsradets-roll/>

Norway

Throughout its history Norway's economy has depended on exploitation of natural resources. Until the end of the nineteenth century fishery, forestry, mining and agriculture were the most important.⁵ In the early twentieth century hydroelectric energy, based on Norwegian waterfalls, created the basis for new, energy-intensive, export-oriented industries producing metals, chemicals, pulp and paper, fertilizers and so on. Closer to our own time, from around 1970 onwards, an oil and gas sector based on exploitation of resources on the Norwegian continental shelf developed.

A knowledge-infrastructure catering for the needs of important industries slowly evolved. A mining college emerged already in the 18th century, well before the country's first university, established in Oslo in 1811. An agricultural university was founded in 1859 and a public research organization (PRO) focusing on ocean and marine research in 1900, both before the establishment of the country's first technical university, NTH, in Trondheim in 1910. At that time the development of the new, electricity-intensive industries was already under way, and NTH – and consulting activities by its academic staff – came to be an important source of knowledge and skills for their subsequent development. Several specialized research institutes serving the needs of particular industries also emerged. In general, Norwegian industry, particularly the natural-resource-based part, preferred to buy services from the PROs rather than investing heavily in internal R&D. As a result the share of R&D in value added in Norwegian industry became relatively low compared to other developed economies while the PROs (or "institute sector") grew rather large. This pattern was strengthened with the rapid growth of the Norwegian oil and gas industry, and the derived demand for knowledge and expertise, from the 1970s onwards, giving rise to an expansion (and reorientation) of the Norwegian PROs to meet the needs of the new industry. Today, the largest of these is NTH's consulting arm SINTEF, established in 1950, with more than 2000 employees.

Modernization

The high dependence on natural resources - and the perceived need to develop a more advanced, knowledge based industry as a substitute or complement to the natural resource-based sector – has been a recurrent theme in Norwegian politics. After the Second World War several influential politicians within the then ruling Labor Party advocated the view that Norway needed to develop a strong presence in the new science-based technologies of the time and the industries they had given rise to, such as

⁵ Another important industry, not directly based on natural resources as traditionally defined but on Norway's long coast line, is the shipping industry.

electronics, telecommunications and nuclear energy. In order to tilt the economy in that direction an elaborate system, with the newly created technical research council (NTNF, established 1946) at its core, was created by the Ministry of Industry in cooperation with other ministries. Other important elements of this system were a series of governmental research institutes in areas such as defense, nuclear energy and telecommunications as well as parts of NTH and its consulting arm SINTEF. A number of firms, some of which newly created, were also involved, and for a while the system appeared quite dynamic. Moreover, the increasing emphasis on R&D (and R&D support) as a useful (and perhaps necessary) policy instrument influenced other ministries, which to a varying degree took steps to develop a supporting knowledge infrastructure in their own fields. Hence, a research council for agriculture emerged in 1946, a general research council in 1949, a research council for fishery in 1972 etc. Thus around 1970 the Norwegian innovation system had acquired a number of distinct features. This included a relatively large “institute sector” (the PROs) with substantial public funding serving various industries and parts of government with knowledge and expertise. A relatively large and diversified “research council sector”, among other things supporting the PROs and their interaction with private firms, had also emerged.

Problems emerge - changes in the policy stance

The drive towards modernization ran into problems around 1980. First, the emphasis on electronics etc., while leading to a number of scientific achievements, did not translate into a lasting industrial success. On the contrary the companies that took part in the modernization drive started to falter one by one. Second, trade liberalization and globalization made it more difficult for government to influence industrial development, for example sheltering “national champions” in selected industries from foreign competition. The wisdom of doing so was also questioned, as it was argued that it might just delay (necessary) structural changes and thus lead to social losses. In short, as in other countries, neoliberal ideology was advancing, stressing the limitations of government and the virtues of free markets, undermining the legitimacy of the activist state-led approach adopted by Norwegian policy makers in earlier years.

One consequence of these changes was that many previously state-owned research institutes were “privatized” and given greater responsibility for their long term survival. The problems that this might have created were cushioned by the rapid growth during these years of the oil and gas sector which became an important customer for many established institutes (such as SINTEF). Moreover, the various research councils were merged into one, NRF, in 1993, in order to, it was argued, making the system more efficient and eliminating redundant (overlapping) activities. However, the organizational set-up of

the new council reflected to a large extent the earlier structure. Moreover, although NFR was owned by a single ministry (nowadays the “Knowledge ministry” responsible for research and education), the other ministries continued to be responsible for research within their respective areas, which implied that the council had to negotiate with each individual ministry about what to do. This procedure, the so-called sector principle, meant that the council often had little leverage when it came to making strategic decisions. To a large extent, rather than shaping priorities and advising government, the new council turned into an executive body for the individual ministries.

The 2000s

Around the turn of the millennium innovation started to get more attention by policy makers and concepts such as “national innovation system” and “holistic innovation policies” became part of their vocabulary. The clearest evidence of this change was the plan for “a holistic innovation policy” developed by the Ministry of Trade and Industry and published in 2003. This plan described a concerted effort for increasing Norwegian innovation, including national as well as regional elements. It also emphasized the need for active coordination among stakeholders and between different parts of government.

Several important changes in the government’s way to conduct innovation policy took place in the early years of the new millennium. In 2002 a dedicated “Innovation Division” was created within the research council to support R&D activities in firms, among other things through so-called “user-governed” R&D projects co-financed by firms and the council, a policy instrument inherited from the Division’s precursor, the technical research council (NTNF). This also holds for a number of targeted programs – to some extent located in other part of the council’s organization structure - supporting interaction between firms and PROs in areas such as ICT, oil and gas technology, fishery technology etc. A new initiative by the council was the establishment of a number of “centers for research-driven innovation” (SFI) – temporary centers of excellence co-financed with industry - in prioritized areas.

In 2002 the government also introduced a new scheme for subsidizing firm-level R&D (“Skattefunn”), in theory a tax-credit, but since most of the firms that apply for support pay very little tax (if at all), the major part of the support is paid out as a subsidy. An important feature of the scheme is a strong incentive for firms to cooperate with external R&D providers, e.g. the PROs, which hence benefit financially from this arrangement. In budgetary terms it is the largest among the government’s innovation policy instruments (Fagerberg 2009). However, only a small minority of Norwegian firms

applies for such support, may be because most of them do not see themselves as R&D performers, or because there is a (rather low) cap on the subsidy.

Two years later, in 2004, the government created a new organization named “Innovation Norway” (IN) through a merger of several existing public bodies providing economic support and services to industry, particularly in rural areas. However, despite the name, most of IN’s budget goes to subsidizing activities in rural areas (and/or primary industries) regardless of the innovation content of the supported activities (Riksrevisjonen 2008). It is possible that the government at the time considered the naming of the new organization to be a first step towards transforming it into a more powerful innovation actor, comparable to TEKES in Finland (see later) or VINNOVA in Sweden. However, in 2005 Norway got a new centre-left government, which – when faced with criticisms of Innovation Norway – defended its ambiguous profile by stating that innovation was only one among several objectives for the organization (Riksrevisjonen 2008). The centre-left government also abandoned the previous government’s attempts to establish forums for coordination about innovation policy among stakeholders and across different parts of government. As a result Norwegian innovation policy today appears fragmented and poorly coordinated, and the country’s public innovation actors arguably lack sufficient authority, competence and resources to really make a difference.⁶

Post-oil?

Since the 1970s the oil and gas industry has grown to become Norway’s major export sector and an important source of income for both the government and the population at large. As a consequence Norwegian wage-levels rose to a level far above the other Nordic countries (while unemployment was much lower than elsewhere). The Norwegian innovation system, and not the least the “institute sector” (which is the largest recipient of funds from the research council, well above the universities), contributed significantly to this success story by adapting to the growing industry’s need for knowledge, skills and expertise (Fagerberg et al 2009a,b). But concerns about the damaging effects of emissions from burning fossil fuels are mounting, and together with the recent decline in oil-prices, this raises questions about the sustainability of the country’s present development path. In the autumn of 2013 a new (right-wing) government took over, and the new prime minister has repeatedly emphasized the need for a change in a “greener” direction. Hence, the question of what policy instruments might possibly contribute to tilt the economy in a more sustainable direction seems increasingly important, and from such a perspective innovation policy might be highly relevant to consider.

⁶ See Spilling (2010) for a more in-depth discussion.

Finland

Compared to its neighbors Finland is an industrial late-comer. Activities based on exploitation of natural resources, particularly agriculture and forestry, dominated the economy at least until the 1970s.

However, subsequently Finland entered a period characterized by high growth, fast structural change and rapid increase in R&D investments with the consequence that Finland today is recognized by the EU as one of the “innovation leaders” in Europe (Innovation Union Scoreboard 2013). Innovation policy, broadly defined, came to play an important role in this transition.

As in several other countries key economic sectors and a “knowledge infrastructure” catering for the needs of these sectors co-evolved over many years. Public research organizations (PROs) addressing the needs of the then powerful agricultural and forestry sectors emerged already before the 2nd World War. The 2nd World War gave rise to a new organization, VTT (The Technical Research Centre of Finland), supporting the Finnish war effort and the manufacturing base on which it depended. After the Second World War VTT ventured into a number of technological fields of relevance for the Finnish manufacturing industry, its transport sector, construction, energy provision etc. Currently VTT has around 3000 employees, and on its website it prides itself of being “the biggest multitechnological applied research organization in Northern Europe”⁷. In the course of time several other PROs have been established by different parts of government to address issues of relevance for them. These organizations, and particularly VTT, continue to be important providers of knowledge-based services, and their role has become a characteristic feature of the Finnish national innovation system. Although nowadays many of them, such as the VTT, get most of their income from customers, they also receive substantial economic support from (various parts of) government.

New public actors

After the Second World War many countries started to pay more attention to the important role played by science and education for long run economic development and Finland, although not among the forerunners, was no exception. A public organization dedicated to supporting scientific research - The Academy of Finland – was established in 1961. Moreover, the number of universities - and the volume of tertiary education – expanded rapidly in the years that followed, with the consequence that the educational standard of the Finnish labor force improved significantly and today is among the highest in the world. Emphasis has also been placed on the development of primary and secondary education, with a particular focus on the qualifications of teachers, and according to the so-called PISA-tests Finnish 15-

⁷ <http://www.vtt.fi>

year-old students rank among the best in the world in reading, mathematics and natural science (Miettinen 2013). Public R&D investment also increased and is currently among the highest in the world when measured as a share of GDP.

A characteristic feature of Finnish innovation policy is the sustained focus on supporting structural changes in the economy away from the initial specialization in natural-resource based products, especially forestry, which for a long time dominated the country's exports. During the 1960s and 1970s several steps were taken to achieve this goal. In 1967 an independent public body supporting technological research, SITRA (The Finnish Innovation Fund), was established (as a part of the Bank of Finland).⁸ Finnish policy makers decided to give priority to the electronics and telecommunication industries, and during the 1970s several initiatives were taken to support the development of national technological capabilities in these areas. In 1983 a new public organization, TEKES (The Technological Development Center), was created to support this process. The political weight attached to TEKES' mission may be illustrated by the fact that its budget expanded rapidly and soon surpassed that of its older (basic research) counterpart, The Academy of Finland. It is also noteworthy that the rapid increase in TEKES' budget continued in spite of the crisis in the Finnish economy around 1990, which resulted in a large drop in GDP and soaring unemployment, and led to significant budget cuts in many areas. In the 2000s TEKES' budget, of which about two thirds goes to firms and the remaining third to universities and PROs, had become twice as large as that of the Academy of Finland.

A system perspective on governance emerges

Finnish policy makers were quick to embrace the new, holistic understanding of innovation which emerged around 1990 under the label "national innovation systems". An important vehicle for the diffusion of the NIS approach became the "Science and Technology Policy Council of Finland", which was renamed "Research and Innovation Council" in 2009 as part of the adoption of "Finland's Innovation Strategy" that year, see later. The council, chaired by the Prime Minister, is an advisory and coordinating body for research, technology and innovation policy, consisting of representatives from relevant ministries, public innovation actors (such as TEKES, VTT and the university sector), major firms, business associations etc. and meets regularly. It also develops plans for the development and implementation of innovation policy in Finland and publishes every 3-4 year a "review" devoted to these issues.

⁸ SITRA still exists but functions more as a strategic think-tank than as a distributor of funds (see Evaluation of the Finnish National Innovation System – Full Report, p. 25).

Miettinen (2013) has analyzed the development of these “reviews” since the early 1990s. The analysis shows that in the 1990s the focus was on strengthening public-private interactions, making the system more effective and – above all – increasing national investments in R&D which was seen a prerequisite for the development of a competitive, high-income, knowledge-based economy. More recent versions of the review has broadened the perspective on innovation with respect to what it is about (including so-called “social innovation” for example), where it takes place (not only in “high-tech”), how innovation may be encouraged (including demand- and user- driven innovation) and what it is relevant for (for instance the public sector as well). This broader perspective was also embraced by “Finland’s national innovation strategy” which was suggested in 2008 by a committee appointed by the Ministry of Employment and Economy and led by the then President of SITRA. The committee among other things suggested making innovation policy a more central part of general economic policy.

Recent trends

In recent years the Finnish government has taken several initiatives to reform the national innovation system. The underlying rationale for these changes appears to be the argument that in a globalized world it is essential for a country to develop a limited number of centres of excellence that can function as global hotspots and points of attraction for skills and resources. These initiatives include a reform of the Finnish university system, through which the individual universities get greater independence, and the creation of a “world-class top university” in Finland – The Aalto University - through a merger of three universities in the Helsinki area.⁹ These reforms have been criticized by Miettinen (2013) for having a democratic deficit. While, he argues, previously large reforms were prepared by committees with broad societal participation, more recently policies have often been shaped by more narrow groups of people hand-picked by the government or individual ministries.

Another initiative has been the creation of a number of so- called “SHOKs” (Strategic Centers for Science, Technology and Innovation) focusing not only on electronics but also on traditional industries such as forestry and metals. The SHOKs are (temporary) centres of excellence financed by industry, i.e., large established firms, and the government (TEKES).¹⁰ However, the panel of experts that evaluated the Finnish National Innovation System, while embracing the university reform, had a more critical

⁹ These were the Helsinki University of technology, the Helsinki Business school and the University of Arts and Design

¹⁰ In Finland innovation policy is also a central element of regional policy, and this includes among other things the establishment of a series of «Centers of expertise». These will not be discussed here. See Evaluation (2009) for a discussion of this issue.

evaluation of the SHOKs, which they considered might contribute to conserve the country's industrial structure, rather than supporting novel initiatives in new areas (Evaluation 2009).

Finnish innovation policy has been characterized by a strong focus on the electronics industry. The prime success story has been the firm NOKIA, which in an amazingly short time transformed itself into a global telecommunications giant. However, in recent years the company has struggled, many jobs have been lost, and its consumer division was eventually sold to Microsoft. Do these experiences imply that the focus of policy and its implementation needs to be reconsidered? This is no doubt an issue that will be discussed in Finland in the years ahead.

4. Concluding remarks

At the beginning of the previous century the Nordic countries belonged to the European periphery, with income and productivity levels far behind the economically leading country at the time, the UK. Since that time first Sweden, then Norway and finally Finland caught up with the UK and (most) other developed economies and are now among the richest countries in the world. Hence, the economic performance of the Nordic countries is certainly impressive, and it is of considerable interest to examine how policy has contributed to this process. While previous studies have looked at labor market issues, social and educational policies etc. (see Dølvik 2013 for an extended discussion), this paper instead focuses on an aspect of the Nordic policy mix that has received relatively little attention so far, namely innovation policy, defined as policies that influence innovation and diffusion of technology (and hence productivity growth).

It was pointed out above that national innovation systems evolve over time through interaction between the economic system of a country on the one hand, and the political and institutional system on the other, and that as a result of this interaction national innovation systems of different countries may end up as looking rather different. This is clearly confirmed in the present case. For instance, Sweden, which had a well-developed university system over a century ago, has developed a national innovation system – and innovation policies – in which universities play a key role. In contrast, Finland and Norway – younger nation states with less-well developed university systems a century ago – developed systems in which public research organizations outside universities – the “institutes” – evolved in close interaction with powerful economic interests. This continues to be the case. However, this does not necessarily

imply – at least not without further in-depth study - that one type of system should be seen as “better” than the other. Different institutional configurations may well be equally efficient.

Such differences notwithstanding, there are interesting similarities when it comes to the conduct of innovation policy in the three countries considered. Particularly in Sweden, but to some extent in Norway as well, quite ambitious policies were pursued during the 1960s and 1970s aiming at supporting and strengthening innovation-diffusion and growth in the leading “high-tech” industries of the time, e.g., computers and telecommunications. Finland adopted this agenda later, i.e. from the 1980s onwards, and possibly with even greater force. A variety of policy instruments were applied in support of this policy objective, including, particularly in the Swedish case, public procurement (i.e. demand-oriented mechanisms).¹¹

However, in both Sweden and Norway direct, pro-active innovation policies of the type discussed here were gradually abandoned as policy-makers lost faith in their effectiveness. As mentioned above it is possible to see this as a response to globalization and increasing EU integration (which arguably constrained the exercise of some previously popular policy instruments). However, the fact that Finland (seemingly with considerable success) turned to policies similar to those pursued in Sweden and Norway at about the same time as they were abandoned in the latter, indicates that it was probably nothing inevitable about the policy shifts that occurred. Hence, it is likely that the change in the policy stance had as much to do with the increasing influence of neo-liberal ideology as with changes in the external environment (e.g., European integration and globalization).

Another common feature has to do with the increasing attention to innovation, particularly from the 1990s onwards, by policy makers in all three countries. Informed by the national innovation approach, instruments aiming at supporting collaborative innovation (particularly interaction between firms and the public knowledge infrastructure) became more prominent everywhere. New organizations within the public sector engaged in designing and implementing innovation policy also came to light in all three countries, e.g., TEKES in Finland (1983), VINNOVA in Sweden (2001), The Norwegian Research Council’s Innovation Division (2002) and Innovation Norway (2004) in Norway.

¹¹ Today both Sweden and Finland retain a significant presence in telecommunications, while Norway does not. However, this does not necessarily imply that the capabilities that these policies helped to generate in Norway did not have an economic payoff. It may just as well be that the payoff occurred elsewhere (as the capabilities thus created were assimilated by the growing Norwegian oil and gas industry for instance).

Nevertheless, Finland stands out by having much more ambitious policies, much greater involvement of the political leadership of the country and other important actors in the policy process, and a much more powerful and well-funded innovation agency (TEKES). Finnish policy makers were early movers with respect to adopting the “innovation system” approach which, as pointed out above, emphasizes the need for policy coordination. Consistent with this emphasis Finland has for several years had a policy coordinating body on science, technology and innovation policy led by the prime minister, that has been a source of inspiration for other countries (Sergey et al 2015). The innovation system approach also had considerable influence in Sweden, as reflected in the formation of VINNOVA. However, as noted by the OECD (2013), VINNOVA is not as well endowed with resources as TEKES, there are many other relevant actors in the Swedish setting, coordination is weak (despite some recent attempts to improve it) and innovation policy does not appear, at least not until recently, to have been an important topic on the central government’s agenda. The latter by and large also holds for Norway, which despite the creation of new, large agencies in this area has developed a relatively fragmented system with little coordination among the relevant stakeholders.¹²

One possible lesson from this study is that the role of innovation policy in economic development has a lot to do with political will and resources, i.e., with human agency. For instance, the experiments with proactive innovation policy in Sweden, Norway and Finland were in all cases supported by (powerful) politicians, who saw this as a way to support important developmental goals. Moreover, the stronger emphasis on innovation policy in Finland more recently, and the willingness there to develop new forms of governance supporting it, evolved in a period of very serious challenges. Finland was around 1990 hard hit by the collapse of the then Soviet Union, its main trading partner, and urgently needed to reorient its economy to new products and markets, for which innovation policy and the required policy coordination apparently were seen as policy makers as useful and legitimate tools. So does an effective innovation policy, aided by the necessary policy coordination, require a crisis (or serious challenge) to get sufficient momentum? Leaving this as it may it is worth noting that challenges are not something that only occurred in the past. In the years to come, for example, the Nordic economies will, together with the rest of the world, have to transform their economies away from using fossil fuels, and for this innovation policy may arguably prove to be very relevant.

¹² Asheim and Mariussen (2010) argue that the innovation system approach has been more influential in Sweden and Finland than in Norway.

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