Skills Ecosystems – a Solution to the Skills Problem? Experiences from the Nordics[1]

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ABSTRACT

Across countries and regions, the lack of labor, skills gaps, and skills mismatch are recurrent problems, frequently labeled as 'the skills problem'. In this Nordic comparative study, we show how the skills problem is framed in a cross-sectoral and multi-level governance context involving education policy, labor market policy and industry and business development policy, as well as actors representing different levels of government. In five Nordic case study regions, we examine how the skills problem is framed and managed in the regional context, and how the regions work with skills analysis, skills development, and skills governance. In recent years, the concept skills ecosystems has gained increased interest. The results show that all examined Nordic regions work with basic elements from this concept, indicating an emergence of regional skills ecosystems. To conclude, the authors discuss how regional skills ecosystems have the potential to contribute to solving the skills problem.

KEYWORDS

labor market policy / multi-level governance / skills ecosystems / skills policy / skills problem / regional development / regional skills ecosystems

Introduction

Across the Nordic Region and Europe, countries and regions deal with what is often labeled as the skills mismatch problem, or simply the 'skills problem'. Global megatrends such as globalization, urbanization, digitalization, and the green transition increase the challenges of the skills problem (European Commission n.d.; ILO n.d.). Solutions to the skills problem are not only expected to contribute to reducing unemployment, decreasing skills gaps, and improving skills match, but also to enhancing sustainable competitiveness, increasing social fairness, and strengthening resilience in crises (European Skills Agenda, European Commission n.d.). While studies of the relationship between human capital and economic growth go back to economists and philosophers of the 18th century such as Adam Smith (e.g., Buchanan et al. 2017b), the skills problem of today is commonly framed as a situation where the skills of the labor force are failing to match the needs in the labor market, which has significant implications on employment and economic growth.

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For a long time, policymakers and academics have understood the skills problem as a matter of matching labor market requirements with skills provision through education at different levels. However, recent research shows that this narrow focus on skills supply and demand oversimplifies the complexity of the issue and neglects contextual demographic, socioeconomic, and institutional factors (Anderson & Warhurst 2012; Buchanan et al. 2017b). The skills problem can also be framed in different spatial contexts. Although national-level policies play a key role, labor markets are largely local or regional (e.g., Aguiar Borges 2020). The rapid innovation and technological developments further exacerbate the complexity of what has been referred to as a 'skills ecosystem' (Buchanan et al. 2017a; Finegold 1999), requiring increased collaboration between key stakeholders from policy making, as well as from the educational sector, the industry sector, and the social partners (European Commission n.d.).

The aim of this research article is to contribute to knowledge about how the skills problem is framed and managed in Nordic regions, whether regional skills ecosystems can be identified, and to what extent regional skills ecosystems can contribute to solving the skills problem.

The article proceeds as follows: It starts by giving a background to the skills problem in literature and in the Nordic context. This is followed by a theory section about the framing and management of the skills problem and skills ecosystems, and by a section on the methods. In the analysis section, we discuss the empirical results from five case study regions in the Nordic countries focusing on key actors at different levels of government, main activities performed, and the most important enabling and hampering factors for the management of the skills problem. In the discussion and conclusions, we elaborate on the development of regional skills ecosystems in the Nordic regions, and whether these can contribute to solving the skills problem. The article ends by pointing out some of the limitations and suggesting further research.

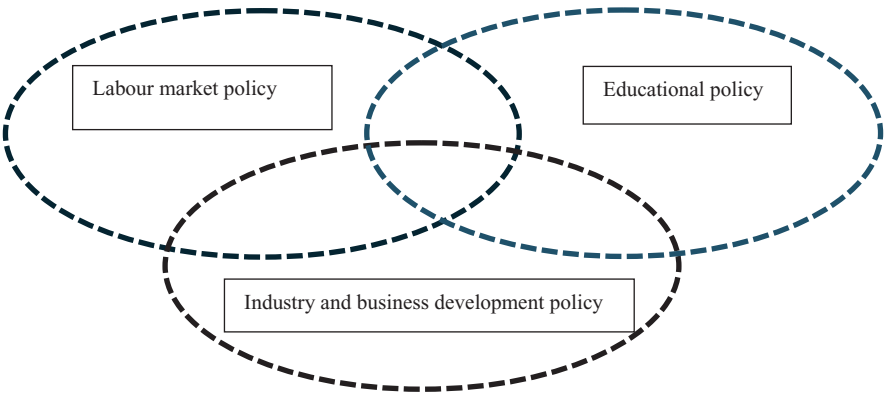
Background

While skills are instrumental to individuals in the labor market and to the development of businesses, skills are also complex in the way they contribute to economic growth in a society by involving different actors, arenas, and systems (Bryson 2017). Despite a general understanding in society of the importance of skills, there is no clearcut definition of skills, since it depends on the context (Toner 2011), and on which theoretical perspective is taken (Bryson 2017). However, a frequent distinction between different types of skills differentiates between generic skills, job-related skills, and company-related skills (Gambin et al. 2016). Skills are frequently targeted in national policy making, aiming at increasing employment and reducing unemployment, but also in an international context, addressed by institutions such as the European Union (EU), the Organization for Economic Cooperation and Development (OECD), and the International Labor Organization (ILO). For example, against the background of the twin transitions of digitalization and the green transition, the European Commission has recently updated the European Skills Agenda aiming at strengthening sustainable competitiveness, ensuring social fairness, and building resilience to future crises (European Commission n.d.).

The framing of skills as a pathway to employability and prosperity shares several of the characteristics of how skills and skills formation are understood in the Nordic

countries. This includes a strong emphasis on the links between skills, prosperity, and economic growth, the role of education, and the significance of skills for the fulfilment of individuals as citizens, social cohesion, and the increasingly important role of employability (Jörgensen et al. 2018). This also indicates that skills policy is found at the intersection between labor market policy, educational policy, and industrial and business development policy, and carries implications for the development in different policy areas.

Figure 1 Skills policy at the intersection between educational policy, labor market policy, and industry and business development policy.



Looking further into these policy areas in the Nordic Region, we find that the Nordic countries share many commonalities due to cultural and historical bonds, such as the Nordic model of universal welfare systems. In the labor market area, this model includes macroeconomic policies aiming at full employment, a key role of the social partners (the trade unions and the employers' organizations) in collective bargaining and in determining the conditions in the labor market, and universal welfare systems which include labor market policy based on institutional support for re-skilling and up-skilling, as well as government in-cash benefits (Alsos & Dølvik 2021). The long history of Nordic cooperation on legislative matters has translated into several Nordic agreements, such as the agreement on a common Nordic labor market (1954) and the convention on social security (1955), and have also paved the way for further collaboration (Lundgren et al. 2024).

However, we also find institutional differences and diverging policy development in the Nordic countries (Alsos & Dølvik 2021; Jesnes & Nordli Oppegaard 2020; Letto-Vanamo & Tamm 2019; Petersen 2019). This can be explained by different historical developments and path dependence which has impacted which actors are involved and the organization and the activities performed (Jörgensen et al. 2018). While Denmark, Finland, and Sweden are members of the EU, Norway and Iceland are members of the European Economic Area (EEA). Despite this difference, all Nordic countries are largely bound by the same EU legislation regarding the single market, as well as EU influence on industrial and business development policy, labor market, and educational policy through directives and EU support schemes and programs.

Looking into the Nordic educational systems, all countries have a similar compulsory nine- or 10-year school minimum. The organization of the upper secondary

school system and the vocational education and training systems (VETs) however differs between the countries. For example, whereas Sweden and Finland have so-called statist VET systems where the government sector has the main responsibility, the Danish system is a part of the collective formation systems where the social partners (trade unions and employers) play a key role. The Norwegian model carries elements from both those systems. The VET systems in the Nordic countries have also undergone several reforms in recent decades (Jörgensen et al. 2018). For example, the Swedish VET system has expanded from being state-dominated and a predominantly school-based system to involve industrial collaboration in industrial schools (Persson & Hermelin 2020).

Also, in the field of labor market policy and labor market systems, the Nordic countries share many similarities. Many of those are linked to the Nordic welfare model with a strong public sector and extensive and ambitious welfare policies. The Nordic labor market model implies a strong involvement of the social partners (i.e., employers' organizations and trade unions), a high degree of unionization, and collective agreements (Kullander & Tönnes Lönnroos 2016). While the Nordic labor market systems contain both so-called active and passive measures (i.e., institutional support for reskilling as well as cash benefits), the organization and implementation show great variety. For example, whereas the public employment service is primarily a municipal task in Denmark (municipal job centers), it is a state responsibility in Sweden (Swedish Public Employment Service) and a joint responsibility between the municipalities, regions, and the state in Finland and Norway [Economic development and labor market bureaus (ELY) in Finland and Norwegian Labor and Welfare Administrations (NAV) offices in Norway]. All Nordic countries have conducted recurrent reforms in the last decades aiming at increasing labor market participation with a strong focus on supply-side activities, that is, the unemployed and their ability and incentives for getting a job (Jörgensen et al. 2018; Kullander & Tönnes Lönnroos 2016).

Also, the area of industrial and business development is characterized by both similarities and differences between the Nordic countries. While all Nordic countries are welfare states, strong export economies scoring high on innovation indices (e.g., European Commission, n.d.; Nordic Statistics n.d.) and have similar overall goals of strengthening economic growth as well as to support rural areas to sustain national cohesion (Slätmo et al. 2024), the institutional set-up, and governance of business development policy at the national, regional, and local levels differs between the countries.

Albeit a generally strong tradition of local government in the Nordic region, we find a variety in the extent and form of devolution of power to lower levels. While Sweden, Norway, Finland, and Denmark have three tiers of government (national, regional, and municipal levels), Iceland only has two tiers of government (state and municipal levels). The regional councils in Denmark, Sweden, and Norway are elected in popular elections, while in Finland, the regional councils are indirectly elected, and in Iceland, the municipalities cooperate in regional associations. The regional councils in most of the countries are responsible for developing and coordinating long- or medium-term regional development strategies with regional stakeholders, while day-to-day business development activities is usually a municipal responsibility or performed in collaboration between municipalities and regions (e.g., in Norway and Finland). In the implementation of the EU regional policy, the organization of the interplay between national-level government and the regions also differs between the countries (e.g., Tillväxtanalys 2021). While this comparison illustrates that the roles and the responsibilities of the regions vary

between the countries, it should also be mentioned that national reforms are recurrent in the Nordic countries (Närings-, trafik- och miljöcentralen n.d.; Sandberg 2018; Tillväxtanalys 2021)

Figure 2 Skills policy in a cross-sectoral and multi-level governance context.

Cross-sectoral governance/ Multi-level governance	Educational policy	Labor market policy	Industry and business development policy
International level	SKILLS POLICY		
National level			
Regional level			
Local level			

In sum, this indicates that skills policy is not only framed in a complex cross-sectoral context of different policy areas guided by their legislations, policy goals, and strategies, but it is also framed by a multi-level governance context which involves policies, actors, and strategies at different levels of government, from international level to national, regional, and local levels.

The public debate on skills, focusing on issues such as labor shortages or skills mismatch, often refers to either the micro-level, for example, a firm or a particular industry, or to the national macro-level. However, skills mismatch may also be related to qualifications, or to different sectoral or regional areas. To a large degree, labor markets are regional, that is they deal with the sub-national scale, which is smaller than the national scale but larger than the local or municipal scale (Aguiar Borges 2020).

In this article, we use the regional lens, and we focus on how the skills problem is framed in Nordic regions – both in the cross-sectoral and in the multi-level governance context just described. While many studies have been performed with a national or local lens, this study contributes to increasing our knowledge about the skills problem from a regional perspective.

Theory

At a very basic level, skills refer to the ability to carry out a particular job.

When conceptualizing skills, it is common to distinguish between generic skills which are transferable across sectors, technical job-related skills which are transferable between employers but not necessarily across occupations and sectors, and company-specific skills which are not transferable (see, e.g., Gambin et al. 2016). Typical measurements of skills include occupational classifications, level of formal educational attainment, qualifications (level and/or subject), and specific competence.

Skills mismatch, which is a part of the skills problem at focus here, typically occur when skills supply fail to meet skills demand. However, measurements of skills mismatches are often imperfect due to the use of proxies (e.g., employment rates, unemployment rates, relative wage levels, and economic growth) and self-reported data from individuals and employers (Gambin et al. 2016).

In academic literature, the skills problem is addressed within different strands of literature. For example, in economic literature, and to a large extent in the public

discourse, the focus centers around issues of supply and demand and around the distribution of costs and benefits between different stakeholders such as the individual, the employers, and the state (see, e.g., Griffin 2016; Hoeckel 2008; Hauschildt 2018). Other strands of literature focus on the institutional frameworks of actors to manage the skills problem, their interests, strategies, and collaboration (Emmenegger et al. 2019), and the involvement of the business sector (Busemeyer & Trampusch 2012 in Persson & Hermelin 2020). The institutionalist approach adds to our understanding of how the skills problem is embedded in an institutional context of actors where developments in the past frame the outcome (Thelen 2004), and how collaboration is structured, conditioned, and embedded in local settings (Persson & Hermelin 2020). To these studies, often focusing on either a sectoral or a regional perspective, literature on governance within the multi-level governance context, including, horizontal, and vertical collaboration (Bache & Flinders 2004), as well as literature on territorial governance and place-based policies (Barca et al. 2012; Moodie et al. 2021) can add to our understanding of the role of context and the mechanisms at play.

Although literature and policy pertaining to the skills problem is often framed as a matter of supply and demand, recent research from different geographies, industrial sectors, and institutional contexts indicate that the skills problem and skills policies are more complex, and that the area would benefit from a more holistic view. Based on research results in Asia, Sakamoto notes that skills policies go beyond the traditional boundaries of supply and demand and suggest a skill ecosystem thinking to achieve more inclusive growth (Sakamoto 2019). Snell (2019) explores the popular view that a strong manufacturing industrial sector requires an equally strong VET sector to provide the skills needed. Snell (2019) finds that the VET system in the fast-changing manufacturing industry in the US overlooks the role of the evolving local skills ecosystems which are more flexible and can more easily meet labor market needs. A study from Wales investigated the role of so-called labor market intermediaries. Besides the necessity to go beyond the supply-side human capital theory paradigm, they find that a broader skill ecosystem paradigm is required to also incorporate structural factors and the foundations of the regional economy (Dobbins & Plows 2017). Also drawing on the skills ecosystem metaphor, a New Zealand study addresses the problems with skills shortages reported by employers in parallel to relatively high unemployment by examining the role of employer-led initiatives at the regional level to address young people regarding future employment opportunities and requirements (Daziel 2015).

The concept 'skill ecosystem' was introduced in 1988 by Finegold and Soskice studying the UK labor market, and it was further developed in a study about the dynamic of self-sustained industrial high-skill ecosystems in California. A 'skills ecosystem' involving interdependent actors and mirroring a natural system was described to contain several common features: a catalyst to create and grow, fuel to nourish the system, a supportive host environment, a high degree of interdependence, and an adaptive capacity to respond to change (Anderson & Warhurst 2012; Finegold 1999). This idea of a skill ecosystem was very much a challenge to the dominant economic thinking of equilibria (aiming at a balance between supply and demand) at that time, with a strong focus on the supply side and the provision of skills through education and training. The ecosystem thinking on the other hand also included the demand side, the deployment of current skills, and the development of new skills. And it also put the notion of interdependence at the center

of the discussion, including interaction between actors, system changes, dynamism, and continual economic evolution (e.g., Buchanan et al. 2017b).

Anderson and Warhurst (2012) identify four main elements of the skill ecosystems: (1) the development of skills, (2) the supply of skills, (3) the demand for skills, and (4) the deployment of skills. They define skills ecosystems as 'a dynamic network of interdependent institutions and actors which through their various interactions, roles, interests, needs and resources is in a constant process of change – evolving in ways that cannot always be predicted – but which shape the development, supply, demand and deployment of skills in any given industry or region' (Anderson & Warhurst 2012, 117). They argue that by placing skill development, supply, demand, and deployment of skills at the center, the focus can be re-directed from the perceptions of increasing skill supply only through the formal institutions of education and training, and toward the development of the skill ecosystem. Mapping out skills ecosystems, Emmenegger et al. (2019) identify six groups of actors involved in the skills ecosystems: individual firms, employers' organizations, educational organizations, employees' organizations (trade unions and work councils), regional public governance institutions, and national public governance institutions.

Directing the focus toward the dynamics of the skill ecosystems is also in line with Hall and Lansbury (2006) who point to the pitfalls of market-based approaches to workforce development and social consensus models, suggesting that to '…be most effective this approach to skill formation requires the facilitation of networks and nurturing of partnerships among the different agents and agencies concerned with skill development' (Hall & Lansbury 2006, 575). Furthermore, it should be noted that the skills ecosystems involve not only formal education but also informal education (Li et al. 2023).

Since its introduction, skills ecosystems have been explored in different national contexts, for example, in the UK, Germany, and Australia (Anderson & Warhurst 2012), but also in cross-country studies (Capsada-Munsech et al. 2020). In spite of increased acceptance of a more holistic and comprehensive view, going beyond skills demand and supply also including the deployment of skills, which is in line with the idea of skills ecosystems, Anderson and Warhurst (2012) however conclude that 'the skill ecosystem concept has been lost in translation'. Despite the growing interest in the concept (Buchanan et al. 2017b), evidence show that policy application has been only partial, and is still largely focusing on the supply side. Recent studies however seem to indicate that the concept skill ecosystems is still of relevance (e.g., Capsada-Munsech et al. 2020; Ramsarup et al. 2023; Wedekind et al. 2021), pointing among other things at the importance of further understanding the multi-scalar and relational dimensions within the skills ecosystems (Ramsarup et al. 2023; Snell 2019), as well as the role of facilitators and further institutionalization of the skills ecosystems (Fung 2020; Wedekind et al. 2021).

Methods

The aim of this study is to increase knowledge about how the skills problem is framed and managed, whether regional skills ecosystems can be identified in the Nordic regions, and to what extent regional skills ecosystems can contribute to solving the skills problem in the Nordic Region.

Three main research questions were set out initially:

1. Who are the actors managing skills in the Nordic regions?
2. What are the key activities performed?
3. What are the enabling and hampering factors?

This research is based on an abductive approach, that is, an iterative research process where the interpretation of empirical facts has been alternated with developing theory based on previous theoretical propositions (Alvesson & Sköldberg 2009). Mixed methods of data collection have been used, including desktop studies of academic and grey literature, as well as in-depth interviews in selected case study regions. The research has been conducted in several successive steps.

A literature review was conducted to familiarize with the different approaches to understand the skills problem, skills policies, priorities, and actors in the Nordic countries as well as to identify some regional examples. This resulted in insights that were developed into an analytical framework containing of three main elements, which was used in the following research process:

1. The skills problem and skills policy are framed in a cross-sectoral policy context, at the intersection of educational policy, labor market policy, and regional and business development policy.
2. The skills problem and skills policy are framed in a multi-level governance setting and include actors from different levels of government.
3. The main activity areas performed by those actors working with the skills problem and skills policy can be summarized as skills assessment and anticipation, skills development (e.g., developing measures to address skills mis-match), and skills governance.

While management of national policies is well documented in academic and grey literature, as well as governments and organizations' websites, documentation about how these policies are enacted at lower levels of government is less well established. To gain in-depth knowledge about how the skills problem is addressed and managed at lower levels of government, six case study regions from the Nordic Region were selected.

To gain insights on the phenomena from different types of regions, a multiple case study design strategy was chosen (Gerring 2017; Yin 2014) following a maximum variation selection criteria strategy (Flyvbjerg 2004) representing a diversity of regions: urban, rural, cross-border, and regions with different industry profiles. Six case study regions were selected, one from each Nordic country:

1. North Karelia (Finland) – a predominantly rural region bordering to Russia, based on bioeconomy, manufacturing, and public sector.
2. Värmland (Sweden) – a small industrial region based on wood industry and manufacturing.
3. The capital region Hovedstaden (Denmark) – an urban region with a diversified economy and cross-border labor from Sweden.
4. Hedmark and Oppland (Norway) – two rural regions strong in, for example, forestry that were merged to Innlandet region in 2020.

5. Northeast region (Iceland) – a predominantly rural and remote region with, for example, fishing industry.

(One case study was also conducted in Greenland. However, due to the Covid-19 pandemic and limited number of interviews, the results from Greenland are not included in this study.)

The case studies included document studies, field visits, and interviews. The selection of interviewees was based on the analytical framework, targeting key representatives from regional and business development, education, and labor market policy areas. The interviewees were identified through the snowball method, and approx. six to eight interviews per case study region were conducted with representatives of, for example, city and regional councils, employment services, educational actors, and representatives from business and industry. The interviews followed semi-structured interview guide focusing on key challenges pertaining to the skills problem in the regions, key actors involved in issues related to solving the skills problem, the main areas of activities, and finally questions about the enabling and hampering factors for dealing with the skills problem.

The case study interviews were recorded and transcribed. In the analysis of the qualitative data, the main themes identified were complemented by new themes and sub-themes emerging from the data. Based on the literature and the empirical evidence, we summarized the tasks performed in the skills systems to three areas: skills analysis (including skills assessment and anticipation), skills development, and skills governance. The comparative analysis of results from the case study regions was documented in a project report focusing on key challenges, main actors, and if and how the actors work with skills assessment and anticipation, skills development (incl. skills mismatch), and skills governance (Lundgren et al. 2020).

During the analysis of the case study results, the question whether the Nordic regions could be said to constitute regional skills ecosystems emerged. This question is further elaborated in the final discussion of the study, as well as the question whether the Nordic regions can contribute to solving the skills problem.

Analysis

Overall, despite the variety of case study regions explored (urban, rural, cross-border, and with different industry profiles), the results indicate that they share several similar challenges in relation to the skills problem. One of them is the disinterest among young people in mathematics and science programs as well as in VET education. Another common challenge is the combination of high unemployment in some sectors and a lack of labor in other sectors. This suggests the relevance of applying a regional territorial perspective (e.g., Aguiar Borges 2020) as well as a place-based perspective (Barca et al. 2012; Moodie et al. 2021) when dealing with the skills problem.

In this section, we will return to the three research questions: Who are the main actors? What are the key activities performed? What are the enabling and hampering factors?

Main actors addressing the skills problem in the Nordic regions

As illustrated in the Background section, the management of the skills problem is framed in the intersection between education policy, labor market policy, and industustrial and business development policy. This indicates that actors from different policy areas are involved in addressing the skills problem, as well as different levels of government.

Table 1 Main actors addressing the skills problem in the Nordic countries

Policy area/ Country	Educational policy	Labor market policy	Industrial and business development policy/ regional development
International	EU; Nordic Council of Ministers	EU; ILO; Nordic Council of Ministers	WTO; EU; OECD; Nordic Council of Ministers; Business sector
Denmark	*National level:* Ministry of Education; Government agencies; Higher education institutions; Vocational Education and Training (VET) *Local level:* Primary and secondary education; Upper secondary education; VET; Business sector involvement in VET	*National level:* Ministry of Labor; Government agencies; Labor market actors (i.e., public sector, employer organizations and trade unions) *Regional level:* Regional employment offices/ coordination *Local level:* Public Employment Services	*National level:* Ministry of Trade and Industry/ Local government; Government agencies; Business sector and their organizations *Regional level:* Inter-municipal cooperation; Regional councils; Regional business and cluster organizations etc. *Local level:* Municipalities; companies; local business associations etc.
Finland	*National level:* Ministry of Education; Government agencies; Higher education institutions; Vocational Education and Training (VET) *Local level:* Primary and secondary education; Upper secondary education; VET; Business sector involvement in VET	*National level:* Ministry of labor; Government agencies; Labor market actors (i.e. public sector, employer organizations and trade unions) *Regional level:* Regional employment offices/ coordination *Local level:* Public Employment Services	*National level:* Ministry of Trade and Industry / Local government; Government agencies; Business sector and their organizations *Regional level:* Regional councils; Centers for economic development, transport and the environment (NTM/ELY); Regional business and cluster organizations etc. *Local level:* Municipalities; companies; local business associations etc.
Iceland	*National level:* Ministry of Education; Government	*National level:* Ministry of Labor; Government	*National level:* Ministry of Trade and Industry/ Local government; Government agencies;

Policy area/ Country	Educational policy	Labor market policy	Industrial and business development policy/ regional development
	agencies; Higher education institutions; Upper secondary education; Vocational Education and Training (VET) *Local level:* Primary and secondary education; Business sector involvement in VET	agencies; Labor market actors (i.e. public sector, employer organizations and trade unions) *Local level:* Public Employment Services	Business sector and their organizations *Regional level:* Regional associations of municipalities; Regional business and cluster organizations etc. *Local level:* Municipalities; companies; local business associations etc.
Norway	*National level:* Ministry of Education; Government agencies; Higher education institutions *Regional level:* Upper secondary education; Vocational Education and Training (VET) *Local level:* Primary and secondary education; Business sector involvement in VET	*National level:* Ministry of Labor; Government agencies; Labor market actors (i.e. public sector, employer organizations and trade unions) *Regional level:* Regional employment offices/ coordination *Local level:* Public Employment Services	*National level*: Ministry of Trade and Industry/ Local government; Government agencies; Business sector and their organizations *Regional level:* Regional councils; Regional business and cluster organizations etc. *Local level:* Municipalities; companies; local business associations etc.
Sweden	*National level:* Ministry of Education; Government agencies; Higher education institutions *Local level:* Primary and secondary education; Upper secondary education; Vocational Education and Training (VET); Business sector involvement in VET	*National level:* Ministry of Labor; Government agencies; Labor market actors (i.e. public sector, employer organizations and trade unions) *Local level:* Public Employment Services	*National level*: Ministry of Trade and Industry/ Local government; Government agencies; Business sector and their organizations *Regional level:* Regional councils; Regional business and cluster organizations etc. *Local level:* Municipalities; companies; local business associations etc.

At the international level, we find international organizations such as the EU, the ILO, OECD, Nordic Council of Ministers, and global companies. Although educational policy is mainly a national policy area, the EU contributes through, for example, policies for ensuring comparability of higher education qualifications (Bologna process) and supporting student mobility (Erasmus). EU also has a pivotal role to support the single market, RnD, and cohesion as well as in the labor market area through regulations,

support initiatives such as the European Skills Agenda, and the European Social Fund (ESF) with supporting mechanisms and funding. The ILO influences through agreements and conventions, and along with other, such as the Nordic cooperation and global firms, contribute to the conceptualization of skills and influence skills development.

Among the actors addressing the skills problem at the national level, we find primarily the national governments who have the overall responsibility for the policy development in the fields of the educational, labor market, and industry and business development policy. These are supported by government agencies, centrally organized or as part of a decentralized structure. The national-level governments are also responsible for the higher education systems. At the national level, the skills problem is also addressed by the social partners which play a key role as in the Nordic labor market model through central negotiations of collective bargaining. Within the industry and business development policy area, apart from national government actors, we also find business sector organizations, such as the Confederation of Swedish Enterprise and the Confederation of Finnish Industries, addressing issues pertaining to the skills problem.

At lower levels of government, we find the regional and local-level actors. However, despite many similarities between the Nordic countries, we find a variety in the devolution of decision-making power, the organization, and/or the implementation of policy at lower levels of government. For example, while the provision of primary and secondary education is a local responsibility in all Nordic countries, the provision of upper secondary education and VET may rest with the municipality, the region, and/or the state depending on the country.

Regarding the implementation of public employment services, we also find important differences between the Nordic countries. While public employment services are primarily organized by municipalities in Denmark, it is the local and regional NAV offices in Norway, the regional ELY-centers in Finland, and the national Public Employment Service in Sweden providing these services.

The implementation of industry and business development at local and regional levels is commonly labeled as 'regional development' and includes issues pertaining to the development of the region, such as transport, communications and other issues related to the skills problem. The main actors are the municipalities and regional councils. As mentioned previously, the exact roles and mandates of these actors vary between the countries. The regional councils in Finland, Norway, and Sweden have relatively strong mandates in regional planning and development (Tillväxtanalys 2021), while in Iceland the inter-municipal organizations have this role, and in Denmark, the national government agency for business development plays the key role.

To summarize, our studies show that the actors involved in addressing the skills problem come from the educational, labor market, and industrial and business development policy area, while the exact set-up of actors is dependent on the institutional framework and context in the individual countries and regions.

What are the key activities performed?

In this section, we turn to the key activities and present how the case study regions engage with skills analysis, skills development, and skills governance.

Skills analysis

The document studies indicate that skills analysis, assessment, and anticipation is conducted at different levels of government, from international level through, for example, EU and OECD, to national governments through public commissions, agencies, and specific task forces as well as by trade unions and other organizations, and at lower levels of government conducted by, for example, regional councils or municipalities. This was also reflected in the case study interviews. In all countries, skills analyses are performed by those actors who are responsible for labor market measures, such as allowances and unemployment benefits, that is, the job centers and the regional labor market councils in Denmark, Public Employment Services in Sweden, NAV in Norway, NTM/ELY in Finland, and Vinnumálastofnun in Iceland. However, also other actors conducted analyses to assess skills supply and demand and engage in processes to anticipate future skills needs, including both quantitative forecasting models and qualitative future studies as well as surveys of, for example, employers, workers, and graduates.

We found a rich variety both in terms of the scope of the analyses (e.g., comprehensive analyses and/or sector-specific analyses) and frequency (e.g., ad hoc and/or systematic analyses). The analyses were performed by individual actors, or in joint processes with several stakeholders involved. However, the coordination among actors seemed to vary between the regions, and we found only a few examples of where skills analyses were taken out in collaboration with actors from different policy areas.

A surprising result was that although the actors interviewed seemed to overall have a common understanding of the nature of the skills problem in their region, only to a limited degree, they seemed to have shared knowledge base about the labor market and the skills situation in the region. The conceptualization of 'skills' was in several cases found to be problematic for the discussion among actors; should skills be framed as a labor market issue, an educational issue or an issue related to long-term economic growth and resilience? Another issue mentioned was which time perspective should be applied in the skills analyses? While a longer time perspective is necessary to comply with the need of general skills and higher educated people, shorter time perspectives are more relevant for dealing with job training-related skills and skills mismatch (Gambin et al. 2016).

Skills development

The second key area examined was how the regions work with activities to address the skills problem in practice, such as lack of skills, skills gap, and mismatch in the labor market. Also, this area is dependent on the mandates and roles of the different actors as was shown in the previous section.

The results from the case studies showed that skills development initiatives were most frequently undertaken through actors in the educational sector, especially actors in upper secondary education, VET actors, and higher education actors. Actors working in the intersection between education, business development, and the labor market sectors were also involved and play an important role in initiating and enabling skills development initiatives. The case studies show a rich variety of how collaboration is organized between actors from the educational sector and other sectors. The case studies

showed that especially the VET sector plays an important role in skills development. As mentioned earlier, Denmark stands out compared to other Nordic countries by having a collective formation system. In the Danish VET system, school-based learning is combined with work-based learning, and it is organized and financed through a formalized collaboration between public sector actors at different government levels, educational providers, individual firms, employers organizations, unions, and other intermediary associations (Emmenegger et al. 2019).

However, also other regions provide interesting examples of how skills development can be organized, for example, distance learning in Northeast Iceland, the multi-actor industrial council collaboration between the educational providers, local industries and trade unions for tailored education and training for key industries in Värmland, and the regional labor market council in the Danish case which is a formalized cooperation between the business sector, the educational sector, and the public employment services aiming at reducing skills gaps in the labor market.

Skills governance

The third key area examined is skills governance, that is, the interaction and collaboration between relevant actors which is taking place at different levels of government. Although several levels of government are involved, the national governments play an overall key role both in terms of overview, policy making, mandate, and resources. At the national level, we also find the dialogue between the labor market social partners, which has a strong role in the Nordic welfare states, not least in periods of structural change (Alsos & Dølvik 2021).

The case study results from the Nordic regions showed that although the actors involved in addressing the skills problem did collaborate, what could be called a joint skills governance system could not be identified. Furthermore, it seemed as if most of the actors had relatively poor knowledge about the other actors involved in managing the skills problem and about their respective roles and responsibilities.

Much of the collaboration seemed to take place on an ad hoc basis, temporary case-by-case, rather than systematically organized. Several of the interviews pointed out the need for more collaboration in general, more collaboration across sectors as well as increased collaboration with employers to reduce the lack of skills in specific business sectors, such as construction workers, electricians, nurses, and social care. Aside from the lack of sufficient collaboration, also, the lack of arenas for meeting and instruments for coordination was also mentioned.

The case study results also showed how the organization of skills governance is framed by the institutional context in the respective countries and regions, which influences who takes on the coordinating role at the regional level. For example, the regional councils in Norway and Sweden have a coordinating role for skills and activities relating to the skills problem. However, previous research has shown that they often lack a clear mandate and instruments for fulfilling their coordinating tasks (Sandberg 2018). In Finland, the national agencies at regional level play a central role, while in Denmark, it is the municipalities who are tasked with the job centers and economic growth along with the national business authority, and in Iceland, the associations of municipalities are gaining an increasing role for regional development.

What are the enabling and hampering factors?

To address the skills problem, skills gaps, and mismatch in the labor market, the interviews point to well-developed and strong educational institutions as important enabling factors, especially institutions in upper secondary education and the VET sector, but also universities and distance education are mentioned. A strong and engaged business sector is also frequently mentioned in the interviews. The importance of collaboration with industry partners and employers is especially raised in the Swedish, Danish, and Finnish case study regions. Another enabling factor raised in a large majority of the interviews across the case study regions was cross-sectoral collaboration and the importance of arenas where stakeholders representing the different sectors could meet.

As one of the most important hampering factors for the development of skills, the interviews point to the lack of adequate collaboration among relevant stakeholders. To a large degree, the interviews showed a lack of knowledge about which actors are involved in issues pertaining to the skills problem and about their roles, responsibilities, and mandates. It was quite common to collaborate with one or two actors; however, in-depth knowledge and collaboration with actors from all three sectors was less common.

One observation is that the size of the regions seems to play a role, where stakeholders in small regions tend to be more acquainted with one another and work more in informal or semi-formal collaborations compared to large regions. Also, the need for more comprehensive analyses and studies, including joint visions and strategies and systematic work was brought up in many of the interviews. However, some interviewees also expressed reluctance toward forming strategies for skills development, with the argument that they would risk being quickly outdated.

Discussion

In this section, we summarize the findings in light of the theory pertaining to the skills problem and skills ecosystems, and we discuss if the Nordic regions could be said to constitute regional skills ecosystems and whether this can contribute to solving the skills problem.

In the study, we started off by showing how the skills problem is framed in the intersection between different policy areas; educational policy, labor market policy, and industry and business development policy. In the empirical analysis of actors involved, we found that the Nordic countries show strong similarities regarding the institutional set up of actors involved in those policy areas. But we also find differences between the countries, especially regarding which competencies and responsibilities are allocated to the regional level.

In the empirical analysis of the key activities performed, we found that although the actors in the case study regions work with elements in all three areas, that is, skills analysis, skills development, and skills governance, a comprehensive approach still seems to be missing in the investigated regions. Furthermore, lack of collaboration among actors was found to be one of the most important hampering factors.

So, this brings us back to the question whether the Nordic regions examined could be said to constitute regional skills ecosystems? To answer that question, we should return to the basic elements of what is conceived as a skills ecosystem. Finegold (1999)

highlighted five key features of skills ecosystems; a catalyst to create and grow; fuel to nourish the system; a supportive host environment; a high degree of interdependence and an adaptive capacity to respond to change. Anderson and Warhurst (2012) identified four main elements of the skills ecosystems; the development of skills; the supply of skills; the demand of skills and the deployment of skills. Along with Buchanan et al. (2017b), Anderson and Warhurst (2012) also underlined the interdependencies, interaction between actors as well as the capacity to manage dynamism and change. This is also in line with Hall and Lansbury (2006) who discuss the importance of facilitating networks and nurturing partnerships to manage the dynamics in the skills ecosystems.

Although the results from the case study regions show that stakeholders from the educational, labor market, and industry and business development policy areas address many of the issues pertaining to the skills problem, it seems more like a patch work of different analyses, strategies, and initiatives than a comprehensive approach or strategy to address the skills problem. Rather, the results show that while some actors are involved in skills analyses, others are involved in skills development and skills governance. The enabling and hampering factors discussed in the analysis section indicate that the regions could benefit from engaging stakeholders across sectors in the regional skills ecosystem, that is, from the educational sector, the business sector, and the labor market sector, as well as from different levels of government. Furthermore, to reap the benefits from the skills ecosystem concept, effective coordination should not only include coordination horizontally within regions but also assure vertical coordination with different levels of government (Bache & Flinders 2004).

Furthermore, collaboration seemed to take place on a temporary or project basis in general, and only to some extent was it systematic and formalized. The lack of comprehensive analyses and shared knowledge about regional challenges in the long-term, mid-term, and short-term perspectives creates a risk that skills analyses and measures aiming at reducing the lack of skills, skills gaps, and skills mismatch may result in single standing and detached project-based activities with limited effects.

In the labor market policy area, labor market policy reforms in the Nordic countries have over time resulted in a stronger centralization which does not sufficiently acknowledge the importance of local knowledge and the need for adaptability to local needs (Kullander & Tönnes Lönnroos 2016). The request for increased integration with other services, for example, social policy, and increased collaboration between state and municipalities (Kullander & Tönnes Lönnroos 2016), resonates well with the results from our Nordic case studies, which emphasize the need for increased collaboration between stakeholders from different policy areas. The main motivation for systematic cooperation according to Anderson and Warhurst (2012) is that skills supply, skills demand, skills development, and the deployment of skills which are '…interconnected and interact, and, by so doing, interdependently affect the nature and dynamics of the system' (Anderson & Warhurst 2012, 117).

The importance of involving the business sector was raised as particularly important in the case studies and has also been raised in previous research (e.g., Daziel 2015; Persson & Hermelin 2020). Buchanan et al. (2017b) point out the need for employer engagement as the most important, but they also highlight a qualified networking capacity and resources to fuel the system as key factors, as well as the need to focus on both content and context of skills and the skills governance between various actors. This is also confirmed in our empirical studies, where the request for more

collaboration between actors across governance levels and across policy sectors was raised in all case study regions.

The importance of the interdependencies between different parts of the system is confirmed in the case study regions. This indicates that not only is it important to identify the actors, their roles, and the skills cooperation within the cross-sectoral institutional context, but when dealing with the skills problem, it is equally important to consider all parts of the regional skill eco-systems, including skills assessment and anticipation, skills development, and skills governance.

To summarize the results from the case study regions, it seems as if we can find elements of skills ecosystems, such as joint analyses performed between actors from different policy areas, collaboration within the VET sector, and in some cases also in other areas. We also find insights expressed in all the case study interviews about the need for increased collaboration across policy sectors, for stronger networks and nurturing partnerships among the actors, not least partnerships with the business sector. This indicates an awareness about the interdependencies, the dynamism, and need for adaptability that characterize a skills ecosystem. However, referring back to the literature on skills ecosystems, the evidence from the Nordic case study regions shows that it is still too premature for the case study regions to be labeled as 'regional skills ecosystems', and at most, we could talk about signs of emerging regional skills ecosystems.

This brings us to the next question, whether regional skills ecosystems could potentially contribute to solving the skills problem in the Nordic regions? Based on our studies, we intend by regional skills ecosystems a region where comprehensive joint analyses are conducted, joint strategies including stakeholders from different levels of government and different policy areas are involved, where actors and their responsibilities and mandates are clear to the other stakeholders in the regional skills ecosystem, and where resources to orchestrate systematic collaboration and joint actions are at hand.

The potential and rationale for adopting a regional skill ecosystem is to be able to reap the benefits through including different perspectives on the skills problem and to access a much larger 'toolbox' by collaborating across the sectors of educational policy, labor market policy, and industry and business development policy. Examples of tools from the regional economic policy toolbox include smart specialization strategies and cluster policy as well as tools to support entrepreneurial and SME development. In the labor market policy area toolbox, we not only find unemployment benefits but also active policy measures such as labor market education tailored to local labor market needs, as well as labor market assessments and analyses of current and future labor market. The educational policy sector has a clear role in the provision of basic and higher education, but in this toolbox, we also find VET and distance learning which have a crucial role in providing skills.

Conclusions

In this study, we have delved into how the skills problem is framed and managed in the Nordic regions. Relating to the theory on the skills problem from different strands of literature and perspectives, as well as the literature on skills ecosystems, we have looked into the cross-sectoral policy context and the multi-level governance context in the Nordic countries and analyzed who are the actors, what key activities are performed,

and what are the major enabling and hampering factors when working with issues pertaining to the skills problem in the Nordic regions.

Our findings show that, across the variety of case study regions examined, they all work with basic elements from the skills ecosystems concept, skills analysis, skills development, and skills governance. However, our empirical studies of five case study regions across the Nordic countries give at hand that even if we find elements of skills ecosystems, it is still too early to talk about fully fledged 'regional skills ecosystems'.

In the Discussion section of the study, we also raise the question whether regional skills ecosystems could potentially contribute to solving the skills problem? A main advantage of applying a regional skills ecosystems approach would be to get a comprehensive overview of the skills problem in the region. Furthermore, by integrating all policy areas into the work, a larger toolbox of measures could be accessed by systematically drawing from all three policy areas, that is, from educational policy, labor market policy, and industrial and business development policy. Another benefit would be to engage a larger set of stakeholders from different levels of government and from different policy areas in the framing of the regional skills problem and how it links to the goals in different policy areas, as well as to deepen the knowledge about the nature of the skills problem, such as the differences between general skills, job-related skills, or company related skills (Gambin et al. 2016) and the subsequent different measures needed to target those different challenges. Several studies (e.g., Buchanan et al. 2017b; Kullander & Tönnes Lönnroos 2016) point to that increased knowledge about the other actors, policies, and measures, and the interdependencies within the system could also contribute to increased adaptability, flexibility, and effectiveness.

The results in this research indicate that acknowledging the interdependencies of the components in the skills ecosystems, involving the main actors from the different policy areas and from the multiple levels of government, and by engaging with the key elements of the skills ecosystems, that is, skills analysis, skills development, and skills governance, in a structured and systematic way, could contribute to solving the skills problem in the Nordic regions. Although 'regional skill ecosystems' might not be a final solution to solving the skills problem, the concept clearly has its merits to capture the interdependencies of actors and interests involved in a complex web of cross-sectoral policies and the multi-level governance context.

By exploring five Nordic countries, this study adds to our understanding of how skills are framed in a multi-level governance and cross-sectoral policy context. Through case studies in Nordic regions, it furthermore contributes to previous research on skills ecosystems by examining to what extent regional skills ecosystems can be identified in the Nordic countries. However, this research is limited to countries and regions in the Nordic context. Another limitation relates to the number of case study regions (one per country) and the choice of case study regions which was based on a maximum variation strategy. While similar findings across different regions can be used as an argument for how regional skills ecosystems unfold in the Nordic Region, they cannot be seen as representative for national variation between the Nordic countries. Finally, the case studies were conducted in 2019, at the same time as policies in the areas examined are continuously developed in the respective countries.

Against the background of previous studies indicating that skills ecosystems do play a role for managing the skills problem (e.g., Capsada -Munsech et al. 2020; Ramsarup et al. 2023; Wedekind et al. 2021) and the indications of emerging regional skills

ecosystems in the Nordic Region presented in this study, further research would benefit from more studies, including in-depth studies to achieve an improved understanding of the mechanisms at play in the interaction between actors from different policy areas and different levels of government. It is also suggested to further explore regional skills ecosystems outside the Nordic context.

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Declaration of interests

The authors report that there are no competing interests to declare.

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