

# DIGITAL TRANSFORMATIONS OF TRADITIONAL WORK IN THE NORDIC COUNTRIES

Report from

**THE FUTURE OF WORK:  
OPPORTUNITIES AND CHALLENGES  
FOR THE NORDIC MODELS**



# Digital Transformations of Traditional Work in the Nordic Countries

Report from *The future of work: Opportunities and Challenges  
for the Nordic Models*

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# Preface from the Project Managers

Major changes in technology, economic contexts, workforces and the institutions of work have ebbed and flowed since well before the first industrial revolution in the 18th century. However, many argue that the changes we are currently facing are different, and that the rise of digitalized production will entirely transform our ways and views of working. In this collaborative project, funded by the Nordic Council of Ministers, researchers from the five Nordic countries have studied how the ongoing transformations of production and labour markets associated with digitalization, demographic change and new forms of employment will influence the future of work in the Nordic countries.

Through action- and policy-oriented studies and dialogue with stakeholders, the objective has been to enhance research-based knowledge dissemination, experience exchange and mutual learning across the Nordic borders. Results from the project have informed, and will hopefully continue to inform, Nordic debates on how to contribute to the Future of Work Agenda that was adopted at the ILO's centenary anniversary in 2019.

The project has been conducted by a team of more than 30 Nordic scholars from universities and research institutes in Denmark, Finland, Iceland, Norway and Sweden. The project started in late 2017 and will be completed with a report in 2020.

In order to address the main aspects of change in working life, the project has been organized into seven pillars with pan-Nordic research teams:

- I. Main drivers of change. Coordinator: Jon Erik Dølvik, Fafo, [jed@fafo.no](mailto:jed@fafo.no)
- II. Digitalization and robotization of traditional forms of work. Coordinator: Bertil Rolandsson, University of Gothenburg, [bertil.rolandsson@socav.gu.se](mailto:bertil.rolandsson@socav.gu.se)
- III. Self-employed, independent and atypical work. Coordinator: Anna Ilsøe, University of Copenhagen/FAOS, [ai@faos.dk](mailto:ai@faos.dk)
- IV. New labour market agents: platform companies. Coordinator: Kristin Jesnes, Fafo, [krj@fafo.no](mailto:krj@fafo.no)
- V. Occupational health—consequences and challenges. Coordinator: Jan Olav Christensen, National Institute of Occupational Health, Oslo, [jan.o.christensen@stami.no](mailto:jan.o.christensen@stami.no)
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- VII. Final report: the Nordic model of labour market governance. Coordinator: Jon Erik Dølvik, Fafo, [jed@fafo.no](mailto:jed@fafo.no)

For Fafo, which has coordinated the project, the work has been both challenging and rewarding. In the final phase of the project, all the Nordic economies were hit hard by the measures taken to slow the spread of the Covid-19 virus. This effectively illustrates how predicting the future of work is a difficult exercise. As our data collection had ended before the virus brought the Nordic economies almost to a halt, we have unfortunately been unable to address the effects of the vigorous countermeasures taken by Nordic governments.

We are very grateful for all the work done by the cooperating scholars, and we would also like to thank our contact persons in the Nordic Council of Ministries, namely Tryggvi Haraldsson, Jens Oldgard and Cecilie Bekker Zober, for their enthusiastic support. Many thanks also to all the members of the NCM committees that have contributed to this work through workshops and commenting on different drafts, and to the numerous interviewees in Nordic working life organizations and companies who shared their time and insights with us.

Oslo, 2020

Kristin Alsos, Jon Erik Dølvik and Kristin Jesnes

Project managers

# Preface from the Pillar Coordinator

In the project, "Future of Work: Opportunities and Challenges for the Nordic Models" (NFoW), funded by the Nordic Council of Ministers, researchers from the five Nordic countries have engaged with seven sub-projects or pillars studying:

- What are the main drivers and consequences of the changing future of work in the Nordic countries?
- In what ways will digitalization, new forms of employment and platform work influence the Nordic models?
- What kind of renewal in the regulation of labour rights, health and safety, and collective bargaining is warranted to make the Nordic model fit for the future?

This report is part of Pillar II investigating how different approaches to digitalization, penetrating the established production system, affect jobs and occupations, work and employment relations, and the strategies of stakeholders (employers, unions and governmental bodies) that are trying to govern this change in the Nordic countries. All the Nordic countries, except Iceland, are included in the report – i.e. Denmark, Finland, Norway and Sweden. The Nordic team of researchers has consisted of Bertil Rolandsson (coordinating Pillar II), Tomas Berglund, and Anna Hedenus (University of Gothenburg), Jon Erik Dølvik and Johan Røed Steen (Fafo/Oslo), Anna Ilsøe and Trine Pernille Larsen (Faos, Copenhagen University), Tuomo Alasoini (Finnish Institute of Occupational Health, Helsinki/Tampere University) and Stine Rasmussen (Aalborg University).

We would like to thank the Nordic Council of Ministers for the funding and all of their support in relation to this report. We also wish to thank the Nordic Council of Ministers' reference group for the project and its Labour Market Committee for valuable inputs and comments, and Kristin Alsos and Jon Erik Dølvik at Fafo for quality assurance. In addition, we are grateful to all the interviewees who have given us insight into the emerging forms of digitalization in parts of the labour market that are crucial for so many employees in today's work life. The authors of the report bear responsibility for any possible mistakes in the text.

Gothenburg, September 2020.

Bertil Rolandsson, Pillar coordinator

# Summary

Research and debates on the impact of digitalization of work often depict the effects as disruptive, and recurrently portray inherited institutions and existing policy co-ordination as out of sync with today's changes at work. This TemaNord report presents empirically grounded studies of digitalization in traditional parts of Nordic working life, enabling readers to assess critically the claim that dramatic technology-driven changes are currently unfolding at Nordic workplaces. Recognized by their well-developed digital infrastructures, stable welfare arrangements and strong social partners, the Nordic countries provide an interesting context for studying how digitalization shapes work and what kind of policy co-ordination is needed to tackle the impact of digital change and other megatrends on jobs, employment and employment relations. The context and framing of the report is outlined in Chapter 1.

Describing how employment and productivity in the Nordic countries have developed during the past 20–30 years, *Chapter 2 shows that the digital transformation thus far has not led to reduced employment, slower job growth or increased labour productivity growth in the Nordic economies.* While confirming that new digital technologies have contributed to reduced employment growth and labour intensity in several industries – for instance, retail, banking, manufacturing and other tangible goods production – the chapter highlights the steady, long-term growth in services employment as a whole, indicating that the economic gains of technological rationalization in some industries have thus far contributed to increased demand and employment in other services industries; this has contributed to rising female employment in particular. Insofar as there has been economic growth, overall job growth has remained quite stable, not least due to solid growth in many female-dominated occupations; thus, the spectre of massive digital job destruction has not materialized. Neither is there any clear trend towards increased growth in labour productivity in manufacturing nor in the services sector as a whole. However, whether these retrospective observations are indicative of future trends or merely reflect that the digital transformation is still in its infant stage, where the widely heralded effects on employment and productivity are yet to come, is indeed too early to say. Clear, still, is that the employment impact of fluctuations in economic growth has hitherto been much more salient than the impact of digitalization of work and production.

Reviewing the main findings from a study we have undertaken of changes in the occupational structure of employment in Denmark, Finland, Norway and Sweden 2000–2015, *Chapter 3 shows that there has been a tendency towards an upgrading of the occupational structure of employment in most Nordic countries, except Denmark.* Changes in Denmark have clearly been moving towards polarization, that is, most job growth at the top and the bottom of the occupational structure, while employment in middle-placed occupations has been declining. In Finland, Norway and Sweden, the trend was towards upgrading, i.e. rising employment shares in occupations with high pay and skill requirements, and decreasing employment shares in low-skilled/paid jobs. The tendency towards upgrading was found both in the female-dominated public sector and in manufacturing and other forms of goods production with declining employment and high shares of male workers. Contrary to



the expectation fuelled by the polarization thesis, a similar upgrading pattern was also found in the services sector as whole, which has been the main engine of employment growth since the turn of the century.

Drawing on a qualitative study of companies in the male-dominated manufacturing sector constituting a corner-stone of the Nordic labour market models, *Chapter 4 shows not only that digitalization blurs existing boundaries between white-collar and blue-collar workers, but also that different digital technologies are linked with different patterns and opportunities for upskilling between different groups of employees.* Based on 65 interviews with representatives of plant management, local trade unions and employees at eight industrial sites in Denmark, Sweden, Norway and Finland, the study examines the micro-level processes that condition different priorities and organizational responses to the emerging demands for digital skills, changes in work organization and upgrading of work in practice. Especially for blue-collar workers, where unskilled jobs tend to disappear (or be outsourced), the changes in job content, skill requirements, job demarcations, and health and safety conditions were mainly perceived as an upgrading of work (for those who remained). By moving beyond descriptions of digitalization as a coherent, unitary force and distinguishing between the digitalization of production, administration and communication, the chapter identifies significant variation in how the industrial actors respond to the demand for upskilling. While bringing clear prospects for job upgrading among most blue-collar workers, white-collar workers do not experience similar opportunities to rise in the occupational structure, but rather, encounter intensified individualized demands within existing positions to keep themselves updated and agile.

Pointing out that the service sectors account for four-fifths of Nordic employment, *Chapter 5 shows that in spite of growing digitalization, increased demand for services has propelled rising service employment – especially in high-skilled service occupations – whereas workers in lesser skilled routine jobs susceptible to digital rationalization face more uncertain job prospects.* As the technological transformation brings further job decline in male-dominated manufacturing and other goods industries, the ability to uphold high and rising employment in the future will largely depend on developments in the service sectors. In recent years, digital technologies have been adopted in a range of business and distributive services, such as banking and retail studied here, bringing changes in work organization, skill demands and slower job growth. By depending on different forms of human interaction with customers/clients, many service jobs in female-dominated personal and social services have thus far been considered less susceptible to technological rationalization. As illustrated in a case study of elderly care, a range of economic, institutional and social factors influence to what extent such services lend themselves to digitalization of work and how it affects employment. By looking closer into three different service industries with very different trajectories of digitalization and job growth, the discussions in Chapter 5 underscore that the employment impact of digital change in services cannot be inferred from the direct effects *within* single industries, but rather, depends on economic growth and the resultant shifts in labour demand *between* different industries. The overall job effects of digitalization in single services therefore depend on the extent to which the gains in productivity and value added are used to boost demand and investment in new jobs elsewhere in the economy, which is indeed influenced by a range of economic-political, distributional and institutional factors. Contrary to the many studies of proliferating low-skilled, casual service work through, for instance, digital

platform companies (see Ilsøe et al., 2020; Jesnes and Oppegaard, 2020), the analyses in Chapter 3 suggest that digitalization in these large, traditional service industries with many female employees tends to propel moves away from routine manual tasks towards more qualified, communicative tasks. In line with the findings in Chapter 3, this indicates that even the services sectors in the digital era are influenced by tendencies of occupational upgrading more than by polarization. A continuation of such tendencies does indeed raise questions about the services sectors' future ability to serve their past function as an engine for the labour market inclusion of workers with little formal education, young people, immigrants and other marginalized groups (Nergaard and Steen Jensen, 2017).

Chapter 6 summarizes and discusses the findings. Aiming to go behind the grand, general narratives of digitalization as a coherent, uniform force of disruption, job destruction and revolutionary change at work, in this study, we attempt to convey a more realistic, nuanced picture of what digitalization means and how it plays out at ordinary Nordic workplaces in traditional sectors. Although our case studies are explorative and the findings must be regarded as preliminary, the picture emerging is sobering. In large, important sectors of Nordic labour markets, the impact of digitalization seems thus far much less pervasive and dramatic than the meta-narratives are telling us, and more marked by gradual adaptation than paradigmatic, disruptive change. The picture we find underpins the analyses in the initial NFoW-report (Dølvik and Steen, 2018), underscoring the idea that technological change is nothing new in Nordic working life, cautioning against technological determinism and emphasizing that the diffusion and adoption of digital technology at ordinary workplaces are bound to take time, leaving scope for evolutionary, pragmatic adjustment of work practices, skills and institutions. Digitalization is not a purely technical process; it also involves broader social and organizational processes where new technologies can apparently be adapted and shaped by the socio-economic rationale and context in which they are implanted. A crucial precondition, however, is that the workforce is provided proper opportunities to upgrade their skills and take part in shaping how new technologies are used. Hence, the connection between digital technologies and the organization of work emerges as a two-way relationship where institutions and politics still matter. Our empirical observations – made before the coronavirus pandemic – also suggest that the actors in the Nordic model of work are largely able to influence this relationship in ways that appear both instrumental and compatible with the *modus operandi* of the model. As many have noted, the coronavirus pandemic has spurred the rapid digitalization of communication and professional meetings, but has also reduced the rate of investment, which is a key prerequisite for the further digitalization of the production of goods and provision of services. Therefore, whether the crisis will accelerate or slow the heralded digital revolution of traditional jobs remains to be seen.

# Chapter 1: Introduction

*Bertil Rolandsson, Jon Erik Dølvik, Tuomo Alasoini and Tomas Berglund*

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A fair share of studies addressing digitalization<sup>1</sup> emphasizes the destructive effects of the introduction of new digital technologies on jobs, work and employment (Brynjolfsson and MacAfee, 2014; Frey and Osborne, 2017; Susskind, 2020). Some other studies offer a far more optimistic account of the impact of digital innovations (Agrawal et al., 2018; Atkinson and Wu, 2017; Daugherty and Wilson, 2018). However, in both instances, inherited institutions and policy co-ordination are portrayed as out of sync with the disruptive transformations associated with the digitalization of work (World Economic Forum, 2016). This report presents empirically grounded studies of digitalization in traditional areas of Nordic working life, allowing readers to assess critically the claim of a dramatic technology-driven change at work in a Nordic context. Recognized by well-developed digital infrastructures, stable welfare arrangements and strong social partners, the Nordic countries provide an interesting context for studying the digitalization of work. When considering the policy responses and co-ordination needed to tackle the impact of digital transformation on jobs, employment and employment relations, it is worth keeping in mind that the future of work will also be influenced by other megatrends. As emphasized in the first report from this project, the processes of digitalization will interact with changes in the global climate, demography and globalization in reshaping work in the coming years (Dølvik and Steen, 2020).

In recent decades, the Nordic countries have been renowned for their ability to combine high, rising employment and technological renewal with increasing shares of jobs characterized by good working environments and high skill and wage levels (Regini, 2000; Katzenstein, 1985; Gallie, 2007). The ability to maintain this type of "high-road" labour market and reconcile efficiency and equality has partly been attributed to the Nordic model, which has been distinguished by comprehensive policy co-ordination between the social partners and governments providing social security and stable labour demand (Andersen et al., 2014; Dølvik et al., 2017). Along with the long-term shift from production of goods to labour-intensive personal and social services, the channelling of sufficient shares of the value added arising from productivity growth into demand-enhancing investment and consumption (Dølvik and Steen, 2018; Fernández-Macías, 2018) has fostered economic conditions essential to why the Nordic countries in the past have been able to combine steady productivity growth, high employment and income security. The tripartite Nordic pattern of policy co-ordination has enhanced labour market restructuring and adjustment (Elvander, 2002; Lilja, 1998). At an international conference about the Future of Work in May 2018 in Stockholm, the Swedish Labour Minister at the time, Ylva Johansson, explained the adjustment capacity of the Nordic economies by referring to the arrangements for (1) strong partnership relations at both local and

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1. In line with established definitions, digitalization throughout this report refers to the connection and integration of multiple technologies into all aspects of production possible to digitize, i.e. to convert into digital information (Gray and Rumpe, 2015).

central levels in working life, (2) a range of support schemes available for companies and employees facing restructuring, downsizing or sudden market fallouts, and (3) the provision of income security and high levels of education in the workforce guaranteed by the welfare states (Kvam and Wallin, 2019). Together, these institutional features have enabled companies, workers, social partners and the state to tackle persistent pressures for industrial restructuring while facilitating technological renewal accompanied by a fair level of organizational innovation and upgrading of workforce skills (Kristensen and Lilja, 2011).

Many studies confirming this view highlight the fact that the Nordic approach enhances flexible adjustment by creating trust and encouraging workers, unions and companies to test out new opportunities and solutions in times when the pressure for restructuring increases (Elvander, 2002; Hernes, 2006; Kristensen and Lilja, 2011). In international comparisons, the Nordic workforces thus show the highest involvement in Europe when it comes to workplace restructuring and willingness to learn new things (Hurley et al., 2017). Many studies also point to the technology-embracing Nordic trade unions when accounting for the broad involvement in the application of new technologies (e.g. robots, automation), allowing Nordic companies to substitute dirty, low-paid jobs for better ones and facilitate new team-based forms of work organization and reskilling of the workforce (Rolandsson, 2003; Alasoini, 2016). Hence, the famous saying of Göran Johansson, one of the most prominent union leaders in Swedish IF Metall, quoted by, for instance, Prime Minister Stefan Löfven, "[W]e do not fear new technology, what I fear is the old technology".

Nevertheless, the possible consequences of working life digitalization in the Nordic countries have also prompted public concern and debate over a set of issues. First, a recurring issue of concern pertains to the impact of digital technologies on jobs and employment. In the aftermath of the Great Recession of 2008, the dramatic warnings of massive job destruction in the studies of Frey and Osborne (2017) and Brynjolfsson and McAfee (2014), among others, sparked a revival of apocalyptic scenarios of the end of work, as we used to know it (Wacjman, 2017). As pointed out in the initial report from the Nordic Future of Work project, the fear that new technology will decimate jobs on a large scale is not new, but has come in ebbs and flows since the introduction of "Spinning Jenny" under the First Industrial Revolution caused the Luddites in England destroy the new spinning machines (see Dølvik and Steen, 2018). Historically, no paradigmatic shifts in production technology have been followed by employment decline, as the value added generated by rising productivity has been channelled through rising wages, investment and purchasing power into increased demand for labour in other companies and branches (Autor and Dorn, 2013; Dølvik and Steen, 2018). Similarly, the steadily rising productivity in Nordic manufacturing and other goods production over the past century has been accompanied by growing employment in other sectors, mainly in private and public services, where rising shares of the female population work. Accordingly, the fears that digitalization would lead to massive joblessness fuelled by tabloid doomsday scenarios have eventually abated and given ground to more nuanced debates about possible job effects and political and institutional prerequisites for maintaining high employment in the years to come (see Arntz et al., 2016; OECD, 2019; Oesch and Piccitto, 2019). The sweeping changes in the distribution of profits, incomes and taxation in the digital, global economy – between countries, sectors, companies and occupational groups – indicate that the Nordic "high road" to full employment in no way will be easy to maintain and will require concerted action within, across and

beyond Nordic boundaries. The employment issue is elaborated further in Chapter 2.

The second major issue related to the digital transformation of work is the profound changes foreseen in the structure of skills, occupations and jobs that in turn will feed pressures for change in the systems of skill formation, education, work organization and industrial relations. When employment shrinks in some occupations or industries and expands in others, it will change labour markets, blur existing job demarcations and alter power relations between organizations on both the labour and employer sides – in some branches, it could even undermine the basis for collective organizations and industrial relations institutions hitherto associated with the Nordic models. In line with recent research highlighting so-called skill-biased technological change (Violante, 2008; Oesch, 2013), new technologies in Nordic working lives have traditionally been viewed as a means to augment labour productivity, improve work environments, raise skills and wages and upgrade the quality of working life. When looking ahead, however, one may wonder whether the optimistic Nordic view of new technology and the institutions underpinning it will prevail when faced with the potentially disruptive effects of the digital transformation. From the outset, digital technologies have been expected to propel knowledge-intensive production and the continued upgrading of work and skills (Castells, 1996). However, more recent research points to aspects of the digital shift that may become more difficult to tackle for the Nordic actors and institutions. For instance, advanced robots, networked machines, additive manufacturing, machine learning and the Internet of things are expected to not only propel sweeping labour-saving automation in important industries, but also disrupt more advanced work processes relying on craft and professional skills – hence weakening demand for higher qualifications as well (Brynjolfsson and McAfee, 2014; Fernández-Macías et al., 2018; Susskind and Susskind, 2015).

Conversely, the advocates of the so-called routine-biased technological change thesis suggest that more advanced computers increasingly may not only substitute workers carrying out manual routine tasks, but also replace workers conducting cognitive tasks in cases where these tasks constitute well-defined sets of activities (Autor et al., 2003). While most studies suggest that the demand for high-skilled labour will still increase at the expense of less skilled workers (Autor and Dorn, 2013; Eurofound, 2017), certain categories of non-routine, labour intensive service work are difficult to replace by digital technology (e.g. hairdressers, elderly care) (Baumol et al., 2012). Premised on sufficient growth in demand for such services, many scholars therefore expect low-skilled, non-routine service work to make up a larger share of employment in the future (Autor et al., 2003; see Chapter 5). By contrast, digitalization tends to replace (semi)skilled routine work, hollowing out the middle layers of the labour market; thus, a widespread expectation is that we will see simultaneous job growth in both high- and low-skilled occupations, leading to growing polarization of the labour market (Autor et al., 2003; Goos et al., 2014; Åberg, 2015; Böckerman et al., 2018). As evidence thus far is inconclusive and changes in the occupational structure of employment seem to vary with cyclical developments and the characteristics of national labour markets and industry structures (Eurofound, 2017), we take a more detailed look at recent changes in the occupational structure of employment in the Nordic countries in Chapter 3 (see also Berglund et al., 2020).

Irrespective of whether the digital shift will contribute to a rising share of jobs, higher skilled/paid occupations (upgrading) or polarization of the occupational job

structure, the increased pace of restructuring and shifts in the demand for skills associated with the digital transformation is likely to strain the Nordic model of policy co-ordination and social partnership. A scenario with ever-increasing demand for high-skilled labour and stagnant employment in occupations in the middle – the traditional stronghold of Nordic collective bargaining and trade unionism – is likely to open up large skill mismatches, require increased investment in retraining and occupational mobility and entail a risk of rising wage gaps. If such a scenario is accompanied by increased labour supply and reduced demand in the lower end, downward wage inequalities are likely to amplify as competition for low-skill jobs intensifies. The past decades' rapid widening of wage dispersion in the lower half of the Norwegian labour market (Dølvik and Marginson, 2018) may be a forewarning about the effects of such dynamics.

The third major question arising whenever digitalization is discussed concerns how the introduction of new digital technology will influence work organization, job content, working conditions, staffing and employment relations. The impact of technology-driven restructuring on the division of labour, the organization and content of work and the local tiers of collective organizations and institutions of the Nordic model – sometimes coined the Nordic micro-model (Hernes, 2006) – will differ significantly between industries, companies and groups of employees with different roles in the production of goods and services. To look closer at what digitalization actually means in different parts of the Nordic working lives and at how the organized actors in different companies and workplaces perceive its purpose, risks and consequences, in this limited "pilot-study", we have explored how digitalization processes unfold and affect "traditional work" and employees in two main sectors of the economy, manufacturing and services – the latter represented by banking, retail and elderly care, which have all been marked by relatively high shares of female employees. As elaborated in Chapters 4 and 5, the aim has been to obtain a more qualified view of how the drivers, implementation and impact of digitalization vary between traditional industries/branches marked by different kinds of production, product markets, main occupations, gender mixes and skills. However, a common feature of the selected industries is that they all belong to the organized core of the Nordic models, boasting strong collective actors and industrial relations institutions. As such, they can shed light on – or perceive themselves – the extent to which the traditional actors and institutions of the models are properly equipped and able to handle the demands arising from the digital transformation.

Through interviews with representatives of employers and organized labour at the workplace/company and central levels, we have sought to obtain a picture of the huge variation in the application and consequences of digital technologies between different domains and groups in working life. The central questions addressed in the interviews included the following: What kind of employer strategies are driving the processes of digitalization in the respective domains? What are the main objectives, considerations, interests and implementation approaches? What kinds of tasks and work processes are affected, and what are the main consequences for management, workers and employment relations? As a corollary, how do the labour representatives respond to management's strategies and to what extent are they involved in the implementation of new technologies and innovation of production process? How do the two sides assess the gains, burdens and distribution thereof between employers and different occupational groups? Finally, an overarching theme of the Nordic Future of Work project is indeed whether the Nordic model is seen as an obstacle or

lever for successful digitalization, and how the changes flowing from it may subsequently influence the functioning and need for adjustments in the model – locally or centrally.

Studies repeatedly point out that the Nordic countries are among the most digitalized societies (Nordic Councils of Ministers, 2015) with the most comprehensive industrial relations systems in the world, as such offering unique opportunities to study the impact of digitalization on work and the institutions regulating it – and vice versa. At the same time, there is no doubt that there are tendencies of erosion in the Nordic models, mirrored in declining unionization and collective agreement coverage, especially in the parts of working life where the workforce is most vulnerable to exclusion during restructuring processes (Kjellberg, 2017; Hvid and Falkum, 2018). As discussed in another report from this project (Ilsøe et al., 2020), these are also the domains where the prevalence of nonstandard employment contracts, work via digital platforms, women, ethnic minorities and labour with scant education and skills is highest. If digitalization hollows out the middle of the labour market in the future and leads to rationalization of many simple jobs in the lower end of the labour market, there is a risk that intensified competition for jobs in these segments will reinforce the tendencies towards the dualization of wages and working conditions observed in recent years (Andersen et al., 2014; Berglund et al., 2020). To counter such dynamics and overcome the skill mismatches that are likely to arise in times of occupational restructuring, improved opportunities for reskilling and occupational mobility will become all the more crucial. Therefore, although the Nordic economies have been renowned for their capacity of flexible adjustment (Katzenstein, 1985; Kristensen and Lilja, 2011), whether the actors and institutions of the Nordic labour markets are sufficiently equipped and agile to master the challenges arising from the digital transformation of work in the years to come remains an open, empirical question. Hopefully, the report from this explorative Nordic study can help provide a clearer picture of the pitfalls and opportunities that may open up along the way.

In the remainder of the report, Chapter 2 reviews recent developments in employment and labour productivity in the Nordic countries since the launch of the Internet made the notion of digitalization familiar in the public. In Chapter 3, we present a review of a quantitative study of changes in the occupational structure of employment in recent decades, shedding light on whether the Nordic countries are moving towards further upgrading or polarization of work (Berglund et al., 2020). Chapters 4 and 5 address developments in manufacturing and services, respectively – illustrated by retail, elderly care and banking – based on qualitative interviews with employer and labour representatives at companies/workplaces as well as central levels. In these chapters, we attempt to unpack what digitalization means for those working in traditional industries and jobs. Here, we explore how the organized actors conceptualize the opportunities and challenges arising from digitalization for their companies, industries and constituencies, as well as for the Nordic model of employment relations in their branches. The concluding Chapter 6 summarizes the main findings from this study and discusses what kind of policy responses and adjustments Nordic governments and organized actors can invoke to make the most of the opportunities and challenges arising from the digitalization of traditional work.

# Chapter 2: Background - Trends in employment and productivity in the Nordic countries

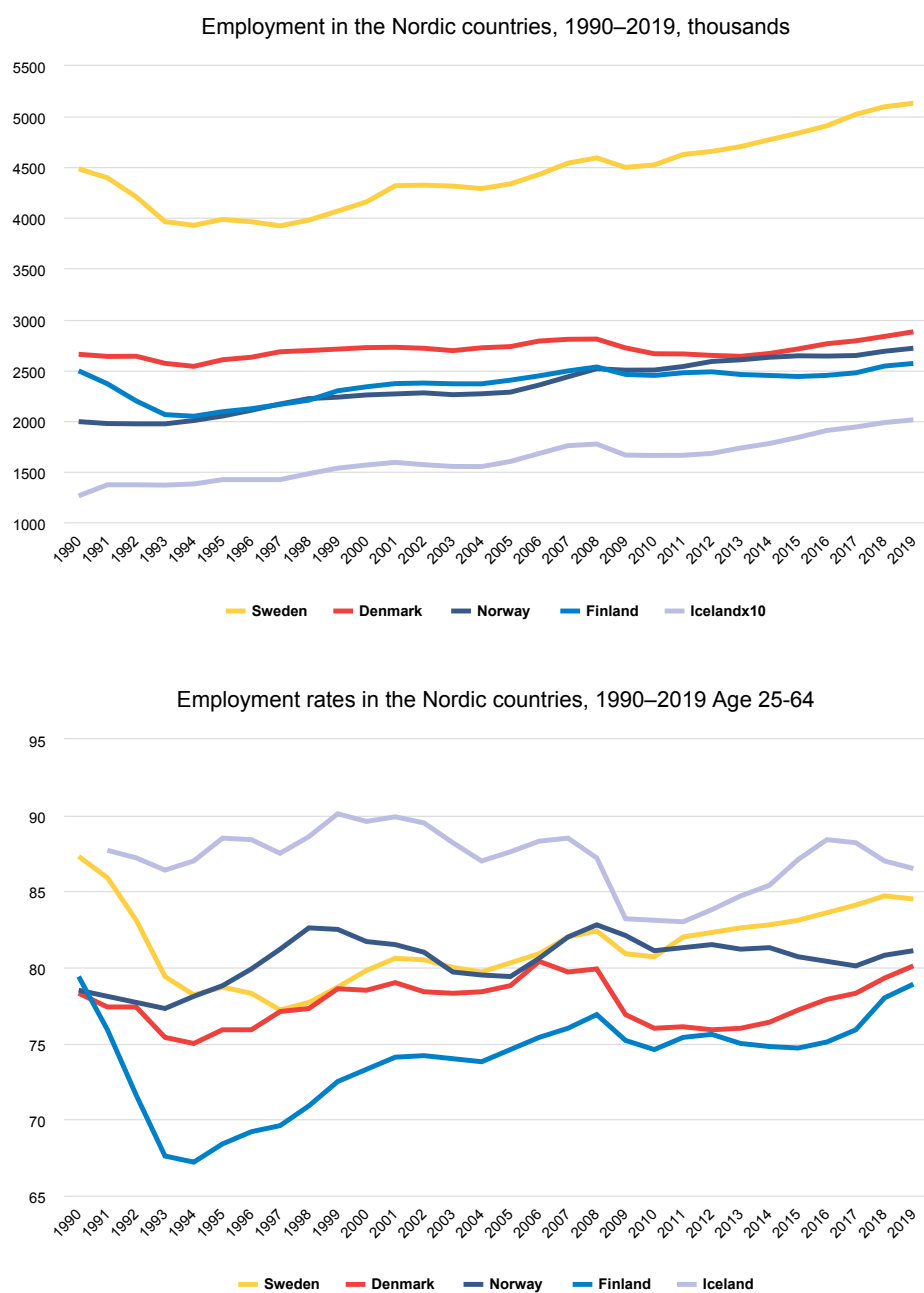
*Tuomo Alasoini and Jon Erik Dølvik*

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## 2.1 Introduction: Employment, digital technology and the tertiarization of work

Already when the data- or EDB-revolution evolved in the 1980s, the prospect of "jobless growth" in Europe triggered a wave of debate and books about automation, the end of work, work sharing, 4-hour days and so forth. This wave soon faded when European job growth eventually picked up, but the fear of mass job destruction re-emerged when digital transformation accelerated in the wake of the 2008 financial crisis. According to the seminal study of Frey and Osborne (2013; see also 2017), the spread of digital technologies, robots and automation was likely to bring about a Fourth Industrial Revolution that would eradicate jobs and employment with unprecedented speed and in unprecedented numbers around the globe. Since then, a range of studies have tempered the fear of massive job displacement leading to technological unemployment, and pointed out that new technologies also open opportunities for new jobs and complement and augment human capabilities in work (e.g. Brynjolfsson and McAfee, 2014, 2017; Ford, 2015; Schwab, 2016; Wacjman, 2017; Baldwin, 2019). In this background section, we take a brief look at developments in employment and productivity in the Nordic countries during the past 20–30 years of growing digitalization and offer some reflections on the main factors that are likely to determine the impact of digitalization on the volume of jobs in the future.



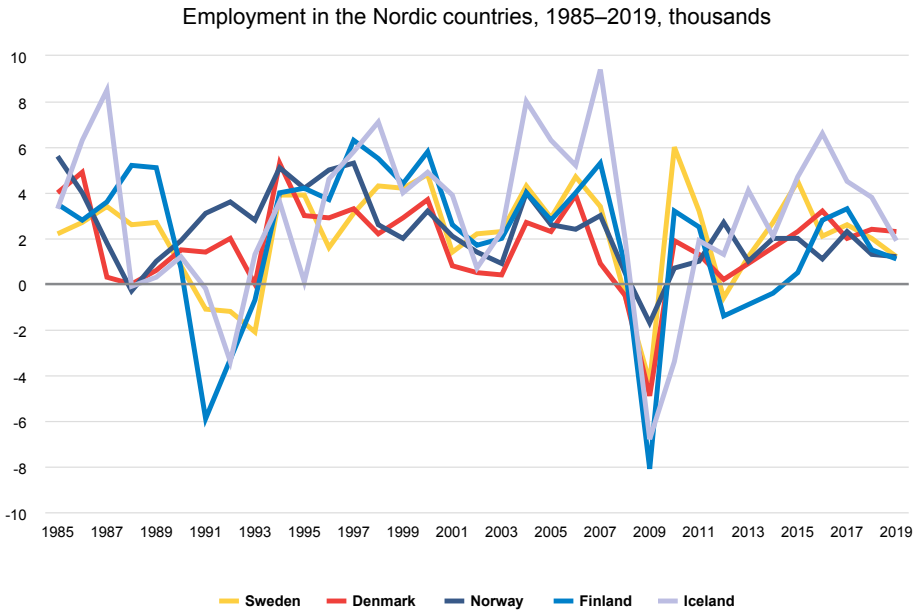


**Figure 2.1: Development in the number of employed people (thousands) and employment rates (age 25–64 years) in the Nordic countries, 1990–2019**  
**Source:** OECD.stat, LFS

The first important observation here is that there is no general tendency towards reduced employment or lower employment rates during the past 20–30 years of digitalization and globalization (Figure 2.1). After a marked drop in employment caused by the recession in the wake of the financial crisis in Sweden, Finland and Norway around 1990, the absolute number of jobs has risen steadily – most so in Sweden and least so in Denmark. Employment growth has been somewhat stronger among women than among men, except in Sweden and Finland after the severe crises in the early 1990s, when strong export recoveries and reindustrialization drove

faster rises in male employment than in female-dominated services (see Appendix 1, Table 2.1). This was different during the slumps in Denmark and Finland after the 2008 financial crisis, when the change in male employment was stronger in both the downswing and upswing phases. Evidently, male employment has been more sensitive to cyclical fluctuations, mirroring the male dominance in manufacturing and construction. The labour market impact of the coronavirus pandemic, which has especially affected services with substantial direct customer contact, differs in this respect.

National job growth is influenced by a range of factors other than technology and economic cycles, not least by demographic change in the working age population. When, for instance, Denmark, Finland and Norway show quite similar employment rates in both 1990 and 2019, although the number of employed has increased much more in Norway, this is because the working age population has increased much more in Norway because of its younger population and higher immigration. In Finland, ageing has brought decline in the labour force, and Denmark has seen stagnation. Similarly, when the highly digitalized Swedish economy shows markedly stronger employment growth than Denmark, Norway and Finland since the 1990s, it probably has nothing to do with differences in the use of technology, but is clearly influenced by faster Swedish population growth, due to higher immigration, and stronger economic growth – especially over the past decade.



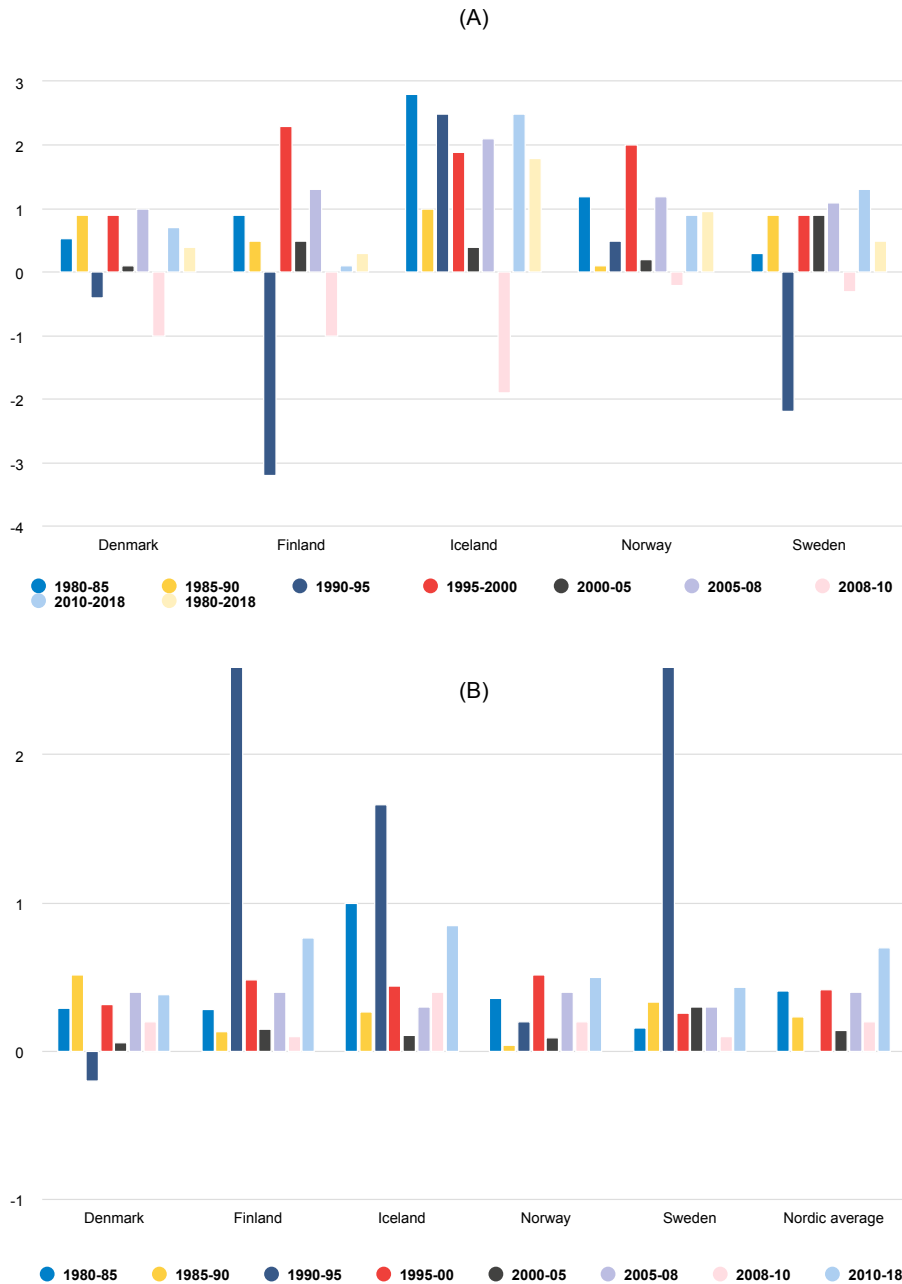
**Figure 2.2: Annual GDP growth (per cent) in the Nordic countries, 1985–2019**

Source: OECD.stat, LFS

A second observation is that the huge ups and downs in Nordic employment since 1990 – as illustrated by Finland and Sweden in the early 1990s, and Denmark, Finland and Iceland after the 2008 crisis – are related to the impact of economic cycles (Figure 2.2), and financial crises in particular. While no general tendency towards lower Nordic employment growth can be discerned during the years of digitalization, a salient lesson is that financial crises tend to cause a large and lasting negative impact on employment. For instance, it took almost a decade after the 2008 financial crisis before employment in Denmark reached pre-crisis levels, and around two decades in Sweden and Finland after their financial crunches in the early 1990s. Evidently, employment change is still strongly influenced by the rate of economic growth.

### **Declining employment effects of growth?**

As technological change tends to raise productivity, a possible effect of digitalization is that it requires stronger GDP growth to generate a given rate of employment growth than before. To examine whether any such effect can be detected in the past decades, Figure 2.3 displays how the relationship between GDP growth and job growth has evolved in the Nordic countries since 1980.



**Figure 2.3: (A) Average annual employment growth in 5-year periods, 1980–2018, and (B) the ratio of employment growth to GDP growth in the same periods**

**Source:** OECD.stat; LFS, National Accounts for 2005–2010).<sup>2</sup>

*\*In Finland and Sweden, which experienced minimal GDP growth and huge net job losses in 1990–1995, the ratios in Panel B went far beyond the scale (2,9 in FL and 22 in SE).*

2. Table 2.1, underpinning Figure 2.3, see Appendix 1.

Looking first at employment growth (panel A), it is salient that the rate of job growth oscillated with economic cycles, being weak – and in several countries strongly negative – during both the slump in the 1990s and the recent 2008 financial crisis. Periods of recovery or boom tend to show strong job growth, as seen under the recovery after the 1990s crisis and during the boom (2005–2008) prior to the financial crisis.<sup>3</sup> In its aftermath (2010–2018), job growth has been very strong in Sweden and Iceland, somewhat weaker in Norway – mirroring the oil price dive in 2014 – and sluggish in Finland and Denmark, both of which struggled with prolonged recessions. In general, there is no tendency towards lower rates of employment growth in the Nordic countries; we observe periods of strong job growth in all four past decades, varying between countries in pace with the cycles.

Looking at panel B – showing the ratios of job growth to GDP growth – there is no clear tendency towards reduced “employment intensity of growth” in recent years. Apart from the exceptional job loss ratios in Finland and Sweden – and also partly Denmark – during the 1990s crisis, the employment impact of growth seems in no way to be weaker in the 2000s than in the 1980s or 1990s. The negative effects of the downturns following the information and communication technologies (ICT) bubble burst (2001) and the financial crisis (2008) are actually weaker than those of the crises of the 1990s. If anything, it might seem as though the positive employment effects of growth have increased somewhat in the past decades of digitalization and labour market tertiarization (shift towards services), mirrored in the more positive developments in female than in male employment. In the last post-crisis period (2010–2018), the employment growth intensity in all Nordic countries is comparable with or slightly higher than that during the post-crisis recovery of the 1990s.

### **The impact of crises, technological change and labour market restructuring**

In line with Schumpeter’s (1942) classic study on crisis, innovation and “creative destruction”, which indicates that crises tend to prompt accelerated restructuring and technological change as old firms and modes of production run out of business and are replaced by new companies and production technologies (see also Freeman and Louçã, 2001; Perez, 2002), several of the Nordic countries saw significant re-industrialization and growth in advanced services during the recovery after the crises of the 1990s. The development of new ICT-related industries and services – especially in Sweden and Finland – came along with rapid growth in labour productivity (Erixon, 2011; Dølvik et al., 2017). At the same time, this period of growing ICT production and digitalization was marked by solid employment growth (Figure 2.1), indicating that rising incomes from the export industries were to a large extent channelled into demand-enhancing investment and consumption in other industries, including labour intensive services. The pace of job growth under the recovery from the 2008 financial crisis may indicate that similar mechanisms have recently been at work, continuing to play a role at least until the COVID-19 pandemic hit in 2020.

Since the turn of the century, the services sectors with high shares of female labour have accounted for virtually all employment growth in the Nordic countries, whereas

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3. The differences in the national rates of job growth visible in panel A in Figure 2.3 reflect differences in economic growth, demographic developments, and industrial structures, among others, that we will not go into here.

employment in the male-dominated primary and secondary sectors have declined steadily despite rising production volumes (Berglund et al., 2020). Some of this decline can be attributed to the outsourcing of support services from manufacturing (see Chapter 4). As shown in Figures 2.1 and 2.3, the pace of job creation and the intensity of job growth have been strong under the boom prior to and recovery after the financial crisis. The links between growth in technologically advanced export sectors and job creation in labour intensive home-market sectors are clearly illustrated in the Norwegian case. Over the past 15 years, phases of rising activity and investments in and revenues from the oil and gas sector have fuelled periodically record-high job growth in both home-based services sectors with high female shares and construction, where strong job growth has to a large extent benefitted migrant male labour from the new member states of the European Union (EU).<sup>4</sup> Thus, growth in technologically advanced sectors – in this case, the male-dominated offshore sector – created spillover effects in the economy and in labour markets in other sectors distinguished by fewer technological advances and high shares of female labour. In some branches, the rising supply of cheap, low-skilled foreign labour, combined with rapidly growing domestic demand, has even spurred a revival of simple, manual forms of work, accompanied by decreasing productivity (growth), for example, as witnessed in the expanding Norwegian construction sector (NOU, 2013).<sup>5</sup>

### **Technological change and the tertiarization of labour markets**

With a long-term perspective, the Nordic economies have been renowned for their high rates of restructuring, technological renewal and productivity growth. This has come hand in hand with high levels of employment and steady job growth, which since the 1980s, have predominantly come in the services sectors; this has contributed to the continued rise in female employment rates. The more male-dominated secondary sectors such as manufacturing and other branches producing traded goods have seen declining employment in recent decades, although production has increased many times thanks to technological renewal, rising productivity and expanding international markets. Outsourcing and an increased focus on core activities have also contributed to growth in service sector jobs. A similar picture largely applies to primary sectors such as agriculture, forestry and fisheries. When looking into the future of work, the ongoing digital transformation is likely to reinforce the trends of rationalization and automation in the production of physical, tangible goods. The question as to whether we are now entering an era with less work and declining demand for labour as a result of advances in digital technology is therefore essentially related to what will happen in the services sectors, where the potential for technological rationalization and automation has traditionally lagged behind manufacturing.

### **Accelerating technological rationalization of services jobs?**

As pointed out long ago (Baumol, 1967), many service industries provide intangible products that require time- and space-bound interaction between the customer and

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4. Similar dynamics were seen in Iceland during its financial adventure when massive investments in hydropower and aluminium plants attracted scores of foreign labour (Dølvik and Eldring, 2008).
  5. Such tendencies have also been reported from construction in several other Nordic countries (Friberg et al., 2014).

provider and cannot be stored. In many labour-intensive services, the potential for productivity growth or rationalization has been low.<sup>6</sup> In the Nordic context, the rising employment share in female-dominated welfare services such as care, health and education is often used to underscore this point. Furthermore, as these kinds of products tend to attract an increasing share of demand when people become richer or more affluent (Baumol et al., 2012), and their providers normally have to offer pay similar to that in other sectors in order to recruit and retain labour, the implication is that services tend to account for a rising share of GDP in affluent, industrialized societies. This has been conducive to the steady rise in female employment in the Nordic countries.

Yet, in recent years, a growing number of services industries have proven susceptible to digital rationalization. We may just think of banking, insurance, transport, logistics, retail, entertainment and media, where digitalized, self-service provision has made many jobs redundant and given way to rising cross-border outsourcing and trading of services. Although many large service industries – typically care, education and health work – are still reliant on direct interaction with customers/clients, an increasing part of the interaction can be mediated by digital means, thereby loosening the time- and space-bound relationship between provider and client. Furthermore, if the labour-saving potential of emerging driverless vehicles is taken into account, the employment effects of digitalization in services may well take a new twist in the years to come and, to a larger extent, affect job opportunities in typical female sectors. However, the size of these effects depends on a range of economic, legal, institutional and behavioural factors influencing whether the gains in terms of productivity and value added exceed the costs of investing in new digital technologies, and the extent to which the resulting value added is reallocated into activities that generate new jobs. The Nobel Prize winner Laureate Robert Solow once noted that, "You can see the computer age everywhere but in the productivity statistics" (Solow, 1987), but much has changed since then.

## 2.2 Productivity development in the Nordic countries

Economic growth and the ability to maintain the preconditions for providing a comprehensive set of welfare services to citizens call for the steady growth of labour productivity. Productivity statistics from the OECD show that despite the high hopes for new digital technologies as a booster of productivity, labour productivity growth in the Nordic countries has been on the decline over the last two decades, with the partial exception of Iceland at the beginning of the new millennium. The same observation largely applies to the whole EU28<sup>7</sup> area and the USA. The Nordic countries managed to catch up the USA in terms of labour productivity until the end of the 1990s, but since then, their growth figures have been quite similar (Table 2.1). As indicated below, the poor growth in overall labour productivity is clearly associated with the shift in employment from manufacturing (and other secondary sectors) with higher levels of productivity to services with lower levels of productivity.

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6. An often cited illustration referred to by Baumol (1967) is the case of a symphony orchestra, whose quality would hardly improve if the speed of the musicians increased.

7. EU28 refer to the member countries of the European Union, including the United Kingdom, before Brexit.

	Denmark	Finland	Iceland	Norway	Sweden	EU28	USA
1971–1980	3.4	4.2	5.2	4.5	2.4		1.5
1981–1990	2.5	3.1	1.2	2.5	1.2		1.5
1991–2000	2.0	3.2	1.2	2.8	2.4		1.8
2001–2010	1.0	1.4	3.5	1.1	1.9	1.2	2.2
2011–2019	1.3	0.6	1.3	0.5	0.8	0.9	0.7

**Table 2.1: Annual change in GDP per hour worked (%), constant prices, in the Nordic countries, EU28 and USA, 1971–2019 (OECD database)**

In Finland and Sweden, manufacturing industries experienced a period of high labour productivity growth in the late 1990s and early 2000s, whereas in 2011–2015, growth practically halted in both countries. Danish manufacturing industries showed much steadier development, with a variation of annual growth figures between 2–4%. In Norwegian manufacturing, labour productivity growth has remained slower than that in the other Nordic countries in most of the five periods, and unlike the other Nordic countries, has been slower than that in the EU28 area as a whole (Table 2.2). In the period as a whole, there is no general tendency towards increased productivity growth even in manufacturing, but rather, the opposite.

	Denmark	Finland	Norway	Sweden	EU28
1996–2000	2.7	7.2	1.8	7.0	3.4
2001–2005	2.5	5.3	4.0	6.1	2.9
2006–2010	3.9	3.0	1.0	4.3	2.9
2011–2015	2.8	–0.3	1.5	0.2	2.1
2016–2019	3.9	3.4	1.0	1.9	1.3

**Table 2.2: Annual change in gross value added per hour worked in manufacturing (%), constant prices, in the Nordic countries and EU28, 1996–2019 (OECD database)**

Average growth figures in the business sector services have remained slower than in manufacturing in all Nordic countries, with the exception of Norway, in which the opposite is true – owing much to the meagre growth in manufacturing. Also, in the case of services, the highest labour productivity growth in all four countries occurred at the turn of the millennium. Sweden experienced another period of high growth in the early 2010s, but since then, productivity growth has remained at a more modest level (Table 2.3). In total, there are no clear indications in business services that productivity growth has increased in recent decades.



	Denmark	Finland	Norway	Sweden	EU28
1996–2000	1.4	2.7	2.7	3.0	2.4
2001–2005	2.4	1.8	3.7	4.2	1.4
2006–2010	1.0	0.6	1.5	0.5	0.5
2011–2015	1.1	0.6	1.7	3.8	1.1
2016–2019	1.8	1.04	1.2	1.0	1.2

**Table 2.3: Annual change in gross value added per hour worked in business sector services (%), constant prices, in the Nordic countries and EU28, 1996–2019 (OECD database)**

Fluctuations in labour productivity growth as well as differences between the countries are the result of many unique and contextual factors that cannot be looked at in more detail in this chapter. Nevertheless, a clear general observation is that the new digital technologies have not lived up to their promise as revivers of productivity growth in the Nordic or other parts of the advanced industrial economies thus far. In many of these countries, productivity growth has slowed down rather than accelerated in the twenty-first century.

No consensus as to why this is the case has been reached among experts. According to one explanation, the most important productivity-enhancing innovations in digital technology are already behind us, and digital technology as a whole does not even have as much significant productivity-enhancing potential as before, for example, the introduction of electric power (Gordon, 2016). However, this interpretation is not accepted by many researchers. According to another explanation, productivity figures measured in the traditional way distort reality. This is due, firstly, to the service dominance of the economy; there are major problems with measuring productivity in many service-intensive industries and activities. Another reason for the distortion is that much of the value created by free commodities (such as Google searches, social media and Skype) enabled by the advancement of digital technology is overlooked in the traditional way of measuring productivity.

Measurement problems may explain part of the phenomenon, but they are probably not the main explanation. Instead of this, many researchers (e.g. Baily and Montalbano, 2016; Erixon and Weigel, 2016; Manyika et al., 2017) consider the overall decline in investment rates in recent years – which has taken a new twist under the coronavirus pandemic – as a more important reason. As a result, only a relatively small proportion of businesses has thus far been able to utilize digital technology to accelerate their productivity development. Many companies have been either wary of bold investments in digital technology and the new ways of organizing work based on this or unable to take advantage of these opportunities to improve their productivity for some other reason. Caution to invest in digital technology has also been attributed to uncertainty about the regulatory environment and economic development in the wake of the Great Recession, changes in corporate ownership structures, weak growth in consumer demand due in part to growing income gaps and the increased use of cheap migrant labour. The inability to take advantage of new technological opportunities in a way that improves productivity is again seen as a reflection of a lack of knowledge or difficulty for companies to reform their management, business thinking and models and ways of organizing work.

## 2.3 Summarizing remarks

As shown in this section, there are thus far no indications that the ongoing digital transformation has come along with a trend towards reduced employment or job growth in the Nordic economies. In addition, no clear tendency towards increased growth in labour productivity, whether we look at manufacturing or the services sector, has been seen. This does not imply in any way that new technology has not contributed to a reduction in employment or job growth intensity in specific industries. We may for instance remind ourselves of branches where output has risen steadily while employment has trended downwards, such as agriculture, banks and retail. However, the overall trends in employment and labour productivity are influenced by developments in all branches and industries – including activities where the practical use of digital technology is very limited – and are strongly influenced by the pace of growth in the national economy. If, for instance, digital self-service and net-shopping lead to fewer jobs and higher productivity in a retail chain, but rising profits and consumer demand tempt the owner to establish a manicure-chain offering former retail staff jobs with lower productivity (and pay), the effect of the digital labour saving in retail can well be that overall employment and labour productivity in services remain unchanged. However, the economy – and, possibly, peoples' welfare – may still grow thanks to the supply of new manicure services. By contrast, if demand growth is sluggish and the retail owner finds the investment in the manicure chain too risky – instead, parking the accumulated profits in an overseas share fund – the outcome would be fewer jobs and less growth. Labour productivity would rise, but so might the number of redundant retail workers who become dependent on unemployment benefits or other support from the welfare state.

Therefore, when assessing the overall job and productivity effects of new technology, one cannot solely look at the direct effects in single industries ("within-effects"), but must also take into account the indirect effects of compositional change in the structure of employment and production across industries ("between-effects"). For example, even though productivity growth in Norway is higher in services than in manufacturing (Tables 2.2 and 2.3), a general shift in production and employment from manufacturing to services will reduce overall productivity growth – and increase the employment intensity of economic growth – because the level of productivity in services in general is still much lower than that in manufacturing. The puzzle as to why the effects of digitalization have not yet shown up in national productivity and employment statistics can probably be explained to a large extent by the countervailing effects of the simultaneous shift from production of goods to services (Bjork, 1999). In this view, the decisive factor for whether technological change contributes to more or less employment is not the direct job effects in the industries where new technologies are adopted, but the extent to which the value added generated by digitally driven productivity growth in these industries is spent in ways that contribute to rising activity, investment, labour demand and jobs in other industries (see also Acemoglu and Restrepo, 2019). As illustrated above by the past decade's discrepant job growth in Sweden and Denmark, such indirect "spillover" effects depend strongly on the rate of growth in the economy as a whole, which is influenced by diverse market forces and a range of other economic, political and demographic factors.

In a historical perspective, the Nordic success in combining high employment with high rates of technological change, innovation and restructuring can clearly be attributed to mechanisms in the Nordic political economies by which the surpluses gained from innovation in technologically advanced (export) industries have been distributed and spent in ways that have spurred consumption, investment and growth in production and employment in other parts of the economy. For example, the Nordic surge in female employment in the 1960–1970s can only be understood in view of the increasing resources that were redistributed via the tax system and used to expand public education and social services, thereby generating rising demand for – and supply of – labour in the public sector. In a similar vein, the relatively stable capital/labour income distribution and the egalitarian wage structure traditionally provided by the co-ordinated Nordic collective bargaining systems have ensured that economic growth (enhanced by technological change) has historically been associated with high rates of productive investment and rising demand from household consumption, both contributing to employment growth in emerging new branches, as well as in existing ones.

In the view that technological progress and innovation have been crucial for the Nordic models' ability to reconcile high productivity and employment, why is there reason to fear that the current digital transformation could threaten the Nordic model by disrupting the relationship between economic growth and employment creation? Why should this time be different? If we, for a moment, preclude the science fiction prospect that robots and artificial intelligence evolve into a self-perpetuating production machine that takes over the economy and makes human labour superfluous, the main reason has to do with distribution and institutional change (Wacjman, 2017). The decline in investment in production seen in recent years may reflect deeper changes in the functional, organizational and distributional mechanisms of the international economy implying that less of the value added generated in the digitalized economy is used to employ people and create jobs. As pointed out in the first report from the Nordic Future of Work project (Dølvik and Steen, 2018), there is a risk that concentration and monopolization of ownership and revenues among the global mega-companies, combined with growing tax competition, wealth leakage to tax havens and investment in paper assets, property and the like, may severely weaken – or disrupt – the links between economic growth, employment, household incomes and welfare services on which the Nordic models are built. Preventing a decreasing part of the surpluses generated in the national economy from being used to pay taxes and invest in activities that improve citizens' lives or tackle unresolved societal problems – and more and more escape into the virtual cloud of footless, financial assets and consumption for the global rich – is not primarily a technological problem, but rather, a political challenge. Also taking into account that demographic changes leading to a decline in the European working age population may restrain growth and propel increasing shortages of skills and labour on demand, this political challenge calls for co-ordinated, transnational action. Such action could include the additional development of international rules enabling taxation of the global digital tech giants, institutions that secure a fair national distribution of wages, income and wealth, and, not least, societal incentive systems that encourage investment in the jobs, skills and life-long learning needed to manage restructuring challenges arising from the shift to an older population, a greener, carbon-free economy and a more digitalized working life.

# Chapter 3: Changes in the occupational structure of Nordic employment - Upgrading or polarization?

*Tomas Berglund, Jon Erik Dølvik, Tuomo Alasoini, Stine Rasmussen, Johan Røed Steen and Pekka Varje*

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## 3.1 Introduction

As pointed out in Chapter 1, the Nordic countries have been renowned for their ability to sustain “high-road” labour markets, with a rising share of high-quality jobs with good work environments and decent wages (Regini, 2000; Gallie, 2007). Technological change and digitalization of work not only affect the volume of jobs in different sectors (see Chapter 2), but also are expected to alter the division of labour, the need for skills and the occupational structure of employment (Brynjolfsson and McAfee, 2017). In the Nordic countries, new technologies enabling the rationalization of work have led to fewer low-skill, routine jobs – for instance, farm workers and timbermen – and more high-skill jobs filled by well-educated labour, historically leading to an upgrading of the occupational structure. This has been associated with a long-term rise in the share of labour with further and higher education, while the job opportunities for labour with low skills or education have declined.

In recent decades, however, new information and communication technologies and the computerization of work have appeared as a drivers of labour market polarization in advanced, industrialized countries, that is, they have strengthened the growth of both high- and low-skill jobs, whereas the share of jobs in the middle of the occupational structure has shrunk. This trend has been especially salient in the U.S., where the surge of jobs in high-tech and financial businesses has been juxtaposed with a huge, expanding market for low-paid services jobs – so-called MacJobs – while skilled working-class jobs in manufacturing have declined (Autor et al., 2003; 2006). Some studies have indicated that similar tendencies have also reached the Nordic shores (Åberg, 2015; Böckerman et al., 2018), but as other studies suggest that further upgrading of the occupational structure is still the dominant Nordic trend (Eurofound, 2017; Oesch and Piccitto, 2019; Tåhlin, 2019), the evidence is far from conclusive. Whatever is right thus far, if growing digitalization propels labour market polarization in the years to come, it might challenge the core features of the Nordic model – the even distribution of good jobs and income opportunities (Berglund et al., 2020) – and weaken the collective bargaining systems anchored in the middle and lower halves of the occupational structure (Dølvik and Steen, 2018).

In this chapter, we review the main findings from a study undertaken in this project of changes in the occupational structure of employment in Denmark, Finland,

Norway and Sweden 2000–2015 (Berglund et al., 2020).<sup>8</sup> Following much of the previous research, we use the median wage as a proxy for the skill-requirements (qualifications) in each occupation. However, this approach has been criticised as a simplification (Oesch and Piccitto, 2019; Tåhlin, 2019). Still, wages, and wage inequalities, are strongly related to not only skills, particularly cognitive ones, but also the supply and demand of those skills in society (OECD, 2015). We have divided the workforce into five wage/skill groups (quintiles) and studied how the relative numbers of jobs in the various wage quintiles have changed in the labour market as a whole and within different sectors.

### Theoretical underpinning of the upgrading and polarization theses

The work of high-skilled employees in advanced, non-routine jobs, for example, technicians, researchers and analysts, are, according to the theory of skill-biased technological change (SBTC), complemented by the new digital technologies, augmenting the productivity of their work (Acemoglu and Autor, 2011). On the other hand, many medium- and low-skilled workers conducting routine tasks, for example, clerical work and repetitive production work, are, according to the theory of routine-biased technological change (RBTC), susceptible to replacement by the new digital technologies through automation (Autor et al., 2003; 2006). As a consequence, it is foreseen that the market for high-skilled labour will expand, developing and using new advanced applications of the digital technology, for example, eliminating labour-intensive routine work, while the market for medium- and low-skilled labour undertaking routine tasks will shrink.

In the scenario flowing from these theories, the main options for labour becoming redundant in medium- and low-skilled routine jobs are apparently to reskill and seek new jobs in the growing high-skill occupations or to enter the ranks of the jobless. According to the polarization thesis, however, an available third option is to accept downward social mobility and start competing for simple, non-routine jobs in the low end of the labour market, which, in recent years, have expanded in many countries, especially after the financial crisis (OECD, 2019).

The theoretical underpinning of the foreseen growth in the low end of the labour market is, firstly, that, in most labour-intensive, non-routine services, such as food preparation and serving, cleaning, gardening or personal care work, human labour is very difficult to rationalize or replace with automatic digital processes or services (Baumol, 1967; Acemoglu and Autor, 2011). Second, despite the limited potential for productivity growth and the pressure to raise wages in pace with other industries – leading to the Baumol “cost disease” – the demand for such services tends to grow in pace with rising household incomes, especially among affluent population groups, whereas various mixes of government subsidies, tax deductions and declines in relative wages tend to keep the cost disease at bay (see Chapter 2).

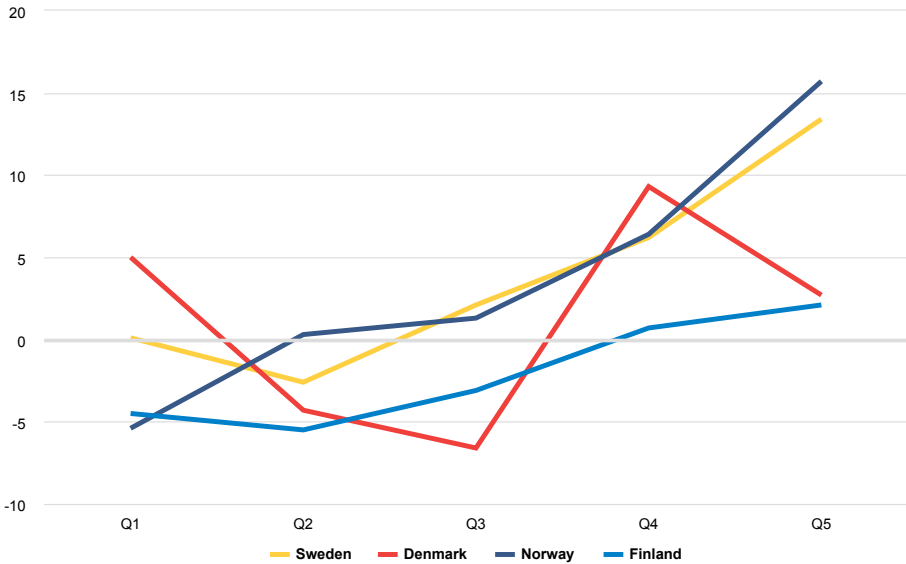
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8. Published in an NFoW-Working Paper (Berglund et al., 2020, [www.fafu.no](http://www.fafu.no)), the study analyses changes in the occupational structure in the labour market as a whole and in different sectors (services vs. goods, public vs. private), examines in which occupations most job growth or decline has occurred and describes how different socio-demographic groups (e.g. gender, age, national origin, education) and types of contracts are represented in various levels of the occupational structure. The study combines data from national Labour Force Surveys (LFS) and wage statistics from four countries. Due to breaks in the occupational classifications, changes are shown for two periods – 2000 to 2010 (Finland 2002 to 2010) and 2011 to 2015 (Finland 2012 to 2016). In 2015, Sweden introduced a new occupational classification in LFS, which made an extension of the Nordic comparison period with more recent years impracticable. In this chapter we only refer main findings from the study. Further details about the methods are found in Berglund et al. (2020).

The scenario that digitalization brings further upgrading of the occupational structure is generally regarded rather positively, enabling upward social mobility while the shrinking job opportunities for low-skilled labour in principle can be remedied by further investment in training and education. The scenario of declining routine jobs and the hollowing out of the middle tiers of the labour market, however, appears more challenging for the Nordic model, boding for huge skill mismatches and demanding labour market adjustments. Whether such a scenario is accompanied by the further decline of low-skilled jobs or the expansion of non-routine jobs in the low end, in line with the polarization scenario, the extra supply of redundant medium-skilled labour is likely to reinforce competition for low-end jobs and impair the employment opportunities of low-skilled groups already struggling in the Nordic labour markets.

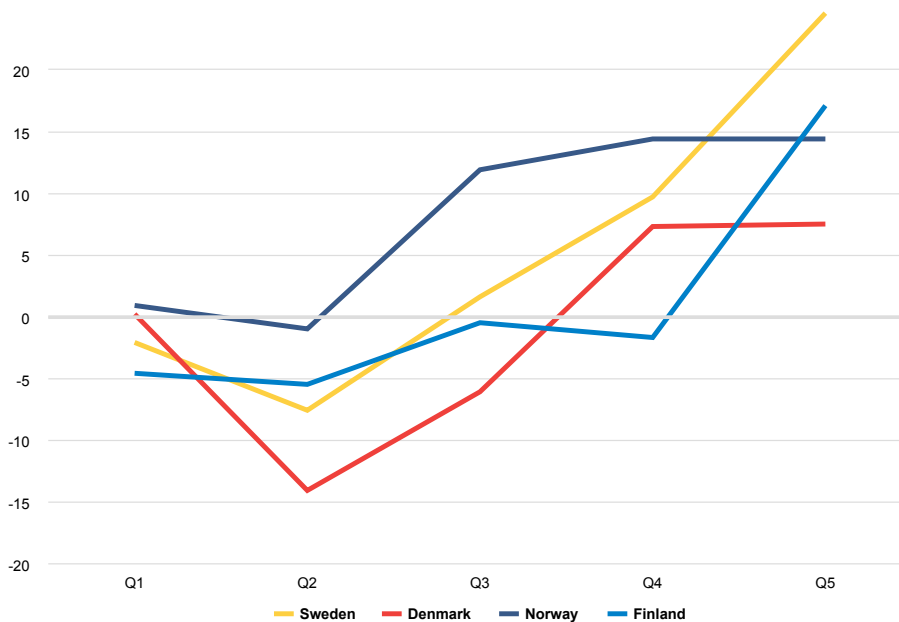
### 3.2 Main findings: Recent changes in the Nordic occupational structures

Which patterns of change have been most salient in the labour markets of the four Nordic countries in recent years? The results from our study show diverging patterns of occupational change ranging from polarization in Denmark to unequivocal upgrading in Norway (Figures 3.1 and 3.2).<sup>9</sup> The patterns of change in Sweden and Finland are less clear, but show a predominant tendency towards upgrading.



**Figure 3.1: Employment change (per cent) in occupational wage quintiles, 2011–2015. LFS, 16–64 years. Weighted data**

9. Table 3.1, underpinning Figures 3.1 and 3.2, can be found in Appendix 2.



**Figure 3.2: Employment change (per cent) in occupational wage quintiles, 2000–2010. LFS, 16–64 years. Weighted data**

Looking closer, we see that in Norway, the strong job growth in occupations in the higher end (quintiles 4 and 5), modest growth in the middle (quintile 3) and declining shares in the lower end (quintiles 1 and 2), fit well with the thesis of SBTC. By contrast, the more polarized pattern of job growth in Denmark, especially during the post-crisis years of 2011–2015, fits better with the thesis of RBTC and polarization, showing growing shares in both ends of the distribution, while the occupations in the middle have decreased in both numbers and shares. The changes in the strong growing labour market in Sweden show a less clear pattern. On the one hand, a significant upgrading has taken place with large increases in the numbers and shares of the two upper quintiles, and also a certain job growth in the middle (quintile 3). On the other hand, the number of employed in the lowest quintile has remained resilient, resulting only in a slightly declining share, while quintile 2, as in the other countries, has shrunk substantially in both numbers and share. Hence, in spite of the dominant upgrading trend, the Swedish development displays a certain polarization of the occupational structure, but the changes are far from as distinct those as in Denmark. In the crisis-hit labour market in Finland, the largest job losses have come in the lower end, and all net job growth has come in the high end – amounting to significant upgrading.

In short, according to our study based on LFS data, the dominant tendency in 2000–2015 has been upgrading – that is, showing the strongest job growth in the high end of the labour market – in three of the four Nordic countries. However, in all four countries, we see marked decline in the number and share of jobs in the lower-middle quintile (Q2), while, except in Norway, employment in the lowest quintile has proven more resilient, and in Denmark, even increased markedly.<sup>10</sup>

10. As the response rate of different groups varies considerably in the LFS data, and the representation of certain groups, for instance, labour migrants, tends to be low, we cannot preclude that studies based on registry data might show higher employment in quintiles 1 and 2, where most labour immigrants find jobs and contracts are often of a more fluid nature.

To what extent can these patterns be accounted for by the theses of SBTC or RBTC? An examination of the specific occupations that have increased or declined provides some clues (see Berglund et al., 2020). In all four countries, strong growth is seen in high-end occupations that are directly related to the new digital technologies (e.g. software and application developers) or for which productivity is augmented by (e.g. technicians, engineers), as well as in all management positions. This fits well with the thesis of SBTC. The decline in occupations such as assemblers, clerks, secretaries and machine operators is congruent with the thesis of RBTC. The same can be said about the observed increases in occupations with extensive customer interaction and fewer standardized tasks, such as housekeeping and restaurant services workers and cleaners and helpers – although changes vary considerably between the four countries.

### Variations across sectors

Changes in the occupational structure of employment vary across sectors and are influenced by many factors other than technology, for instance, shifts in product markets, cyclical swings and political decisions. Shifts in labour supply, working time and employer staffing strategies may also influence the number of persons employed in a given occupation. As the aggregate figures can hide divergent trends in different areas of the labour market, our study looked into how the occupational structure evolved within different sectors in this period. The main findings are summarized below (see Berglund et al., 2020 for further elaboration):

- In the production of *tangible goods*, including *manufacturing*, overall employment declined in all four countries and job growth was seen only in the higher end (quintiles 4 and 5), while the job losses were concentrated in occupations in the middle and lower ends. The only exception from this pattern of unequivocal upgrading was found in Denmark, where some job growth in low-skilled occupations associated with the food industry contributed to polarization.<sup>11</sup> The ways and mechanisms through which digitalization contributes to changes in the division of labour and upgrading of the skill structure in manufacturing are further discussed in Chapter 4.
- As shown in Chapter 2, the *services sectors* have accounted for all net employment growth since 2000. Comprising high-skill occupations in private business and the public sector as well as routine-based occupations in the middle – e.g. banking and office clerks, lending themselves to technological rationalization – and low-skill, non-routine jobs in the lower end, one would expect the services sector to be a prime example of polarization. However, the only case fitting this expectation is Denmark, whereas the services sectors, especially those in Norway and Sweden, but also in Finland, show upgrading with almost all job growth being concentrated in the top and middle.
- Looking into specific occupations, examples of rising services occupations in the higher end are, as mentioned earlier, typically software and application developers, sales and purchasing agent brokers and professionals in finance, health and teaching. Rising services occupations in the lower end are, for instance, client information workers and food preparation workers, whereas shop salespersons have declined everywhere but in Finland.

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11. The main examples were "manufacturing laborers" and "food and related machine operators".



The study also found unexpected, deviant results, for example, a strong decline for primary school and early childhood teachers, as well as heavy truck and bus drivers in Denmark 2011–2015 – in contrast to the other countries – underscoring the importance of considering factors other than technological change. The decline in Danish bus and truck drivers may have to do with increased foreign competition after the EU enlargement, whereas the decline in primary/preschool teachers may reflect demographic changes and/or cuts in municipal budgets after the financial crisis, offering a reminder that political decisions can also be important for propelling occupational change.

In this view, we compared employment changes in the *private and public sectors* in Finland, Norway and Sweden in 2011–2015 (the LFS data in Denmark is missing a good indicator for private/public employment), showing interesting variations:

- In *Norway*, the general upgrading trend was mirrored in both the private and public sectors, where solid oil-driven economic growth fuelled rising domestic demand and significant job growth in high-skilled service occupations with sizeable female shares. In the shrinking labour market in *Finland*, an upgrading tendency was clear in the female-dominated public sector, whereas large private sector job-losses in male-dominated lower-middle occupations (Q2) contributed to polarization there.
- In *Sweden*, the patterns of change diverged between the private and public sectors. The former showed a strongly polarized pattern of job growth, whereas the female-dominated public sector showed clear upgrading, as in the other countries. This contrast was accentuated by a transfer of low-paid services jobs from the public to private sector, in particular, personal care and related workers, which decreased and increased with more or less the same numbers in the respective sectors. These changes mirror the widespread privatization or outsourcing of public services during the period, again offering a reminder that factors other than technological change influence the structure of the labour market, although this instance of sector gliding had no effect on the overall occupational structure of employment.

### **Variations in contract forms and socio-economic composition across occupational tiers**

Unsurprisingly, the socio-economic composition of the workforce differs substantially between the upper and lower tiers of the occupational structure (Berglund et al., 2020 and Table 3.2 in the Appendix 3). These differences largely follow the same pattern in all four countries:

- In the occupations in the low-end (quintile 1), women, young, foreign-born and low educated workers are strongly overrepresented. Sweden stands somewhat apart though, with a higher share of immigrants and prime age workers in quintile 1, where quite a few also have secondary and sometimes even tertiary education.
- The occupations in the middle (quintile 3) are, in all instances, strongly dominated by native labour, and in Finland and Denmark, show a marked majority of males and workers with secondary education. In Sweden, by contrast, the majority are women and have higher education, whereas Norway

lies in between in both respects.

- In the occupations in the top (quintile 5), men, natives, highly educated and people in the 35–44-year age group are significantly overrepresented. Yet, the share with tertiary education is notably lower in Norway and Denmark than in Sweden and Finland, whereas the share of women is highest in Sweden (41%) and lowest in Norway (31%).

From the literature on labour market *segmentation* and *dualization* (Ilsøe et al., 2020; Emmenegger et al., 2012), it is well known that “nonstandard” employment contracts tend to cluster in low-end occupations with low skill requirements and pay. Hence, the findings referred to below are not surprising:

- The prevalence of “nonstandard” contracts is much higher in quintile 1 than in quintiles 3 and 5. In Denmark and Norway, short part-time work is especially overrepresented in the low end, whereas temporary employment is particularly frequent in quintile 1 in Finland (21.7%) and Sweden (28.5%).
- In the occupations in the top quintile, by contrast, almost all employees – around nine of 10 – enjoy standard, full-time employment contracts. The same pertains to the majority of workers in the middle quintile (Q3), where around four of five have standard employment contracts.

The findings of our study confirm that the occupational wage/skill structure is changing, which may affect workers' employment conditions, job stability and levels of earnings and income security. Changes in the occupational structure of employment may thus impact the job quality, living conditions and employment prospects of different social groups. In the study undertaken in this project, we used median full-time wages as a proxy for occupational skill levels. However, this is not an indicator of the actual earnings and incomes of individuals in different occupations, which, to a large extent, also depend on working hours and the duration of employment uninterrupted by spells of joblessness. The clustering of disadvantages flowing from the overrepresentation of certain groups and concentration of non-standard employment in the lowest paid quintile – most pronouncedly in private services (Ilsøe et al., 2020) – is in this regard particularly problematic. Females constitute the main share of employed in the lowest paid occupations (quintile 1), while men are in majority in occupations in quintile 2. Over time, however, females have benefitted from the continuing changes of the occupational structure (see Appendix 4, figure 3.3 and 3.4). In both Norway and Sweden (missing data from DK and FI), females have in the period 2011-2015 shown markedly stronger rate of employment growth than males in the upper half of the occupational structure and especially in the highest paid occupations (quintile 5). Thus women in both instances saw a strong upgrading of their occupational pattern, whereas, by contrast, Swedish men saw a pronounced polarization with substantial decline in the middle quintiles (2-3) and solid growth both in the bottom and top. Among Norwegian men, almost all job growth came in the top, while there was almost zero growth in the middle and decline in the low end.<sup>12</sup> While declining, women in both countries still constitute the large majority in the lowest-paid end of

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12. This may partly reflect that the high numbers of male labour migrants from CEE-countries working in low-paid/skilled jobs in Norway probably are underrepresented in the Labour Force Survey.

the occupational structure (quintile 1),<sup>13</sup> whereas men dominate in the second lowest paid occupations (quintile 2), implying that men held 52 percent of the jobs in the lower part of the occupational structure in Norway and 46 percent in Sweden in 2015.

### 3.3 Summary

All in all, the analyses in the study referred to here, based on LFS data (Berglund et al., 2020), show that the occupational structure of employment in Denmark, Finland, Norway and Sweden is changing. The patterns of change vary somewhat between countries and sectors. In the labour market as a whole, the changes in Denmark, especially in 2011–2015, are clearly towards polarization, that is, job growth at the top and bottom, with a decline in the middle. However, in Norway, Sweden and Finland, the predominant trend is towards upgrading – that is, relatively more jobs in occupations with high pay and skill requirements, relatively fewer low-skill/paid jobs and mixed tendencies in the middle of the occupational structure. According to a recent analysis from the OECD (2019), the relative stagnation or shrinking of middle-layer jobs is mainly due to fewer job openings and recruitment in such occupations as opposed to the displacement of existing workers. In the Nordic countries, this pattern is apparently clearer in male-dominated occupations in goods production compared with among women, where the expansion of social and health services provides more job openings in female-dominated occupations. The tendency towards upgrading in these three countries is the most pronounced in the public sector and in manufacturing and other goods production; however, contrary to the expectation fuelled by the polarization thesis, a similar pattern of upgrading is found in the services sector as whole, which has been the driver of employment growth since 2000.

Some of these changes can certainly be explained by the development of new (digital) technologies – evidence supporting this explanation includes the increase and decrease of particular occupations; however, our study underscores the fact that other factors interfere as well. Politically contingent changes in public sector organization and the transfer of jobs from the public to private sector affect the overall employment structure as well as the occupational structure within each sector. Moreover, the study indicates that cyclical swings or economic shocks, such as the financial crisis in Denmark and double-dip recession in Finland (2008–2014), and changes in labour supply, for example, due to immigration, influence the pace and direction of occupational change. It is notable that the predominant upgrading tendency in Norway and Sweden came in a period of solid employment growth, while the polarization tendency in Denmark came in a period of sluggish Danish employment growth under the 2008–2014 downturn (see Chapter 2). A central question for future studies is how the changes in the occupational structure analysed here influence wage and income inequalities. Although upgrading may enable more workers to move into better-paid occupations with more standard employment contracts, while polarization pressures a larger share of the workforce into occupations with low pay and unstable employment, the effects on wage distribution ultimately depend on the actual pay differentials between the various

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13. The female share fell in 2011–2014 from 78% in 2011 to 74% in 2015 in Sweden, and 65% respectively 64% in Norway.

tiers in the occupational structure. In fact, in the period under study, wage inequality as measured by the ratio between wage deciles 1 and 9 has increased the most in Norway and the least in Sweden – both countries showing upgrading – while Denmark and Finland lie in between, indicating that the changes in wage distribution are strongly influenced by institutional factors.

# Chapter 4: Nordic manufacturing in transition - Perspectives on digitalization and skill requirements

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## 4.1 Introduction

Chapter 3 pointed out that recent changes in Nordic labour markets, and manufacturing in particular, have largely followed the path of skill-biased technological change (SBTC), facilitating the upgrading of work. By providing opportunities for more qualified work tasks, higher wages and better working environments, digital technologies manifest themselves as vehicles for workers to move up the skills and occupational ladder, in many cases, blurring the boundaries between work tasks performed by blue- and white-collar employees. However, at the same time, technological development is expected to foster further automation of work and, as outlined in the previous chapters, a decline in the number of routine jobs (Susskind and Susskind, 2015; Frey and Osborne, 2017).

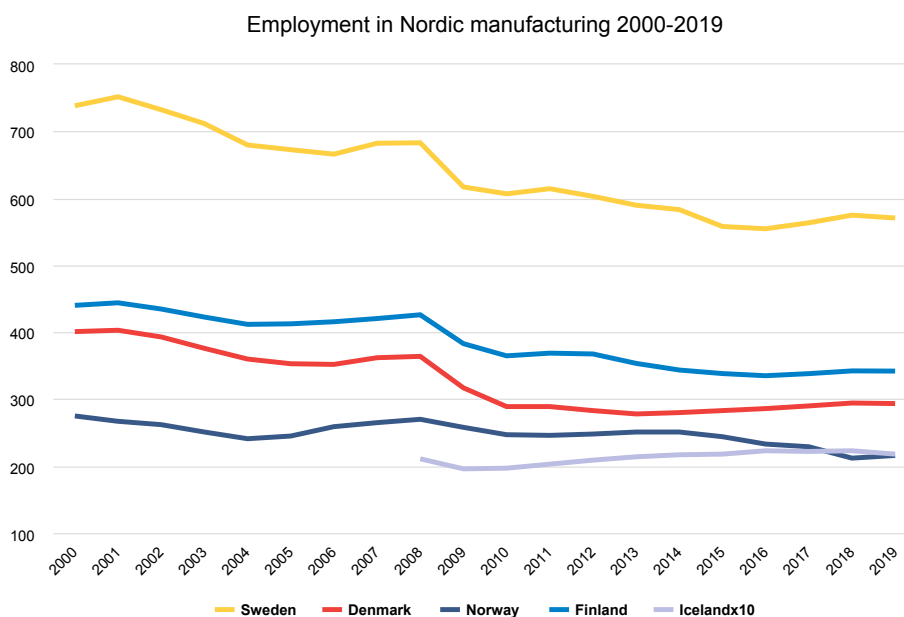
While the previous chapter took a bird's-eye view of the changes in the occupational structure of Nordic manufacturing, this chapter draws on a qualitative analysis that looks more closely at the micro-level processes of digitalization in eight Nordic manufacturing companies, focusing on changes in skill demands, work organization and employment relations. Accounting for a sizeable share of Nordic exports, GDP and jobs for blue-collar workers, manufacturing has been a corner-stone of the Nordic model of industrial relations, and has gone through several rounds of industrial and technological transformation. This also applies to the eight large companies in machinery production studied here, which, in recent years, have introduced a range of digital production equipment and information and communication technologies-based production processes that can be described as Industry 4.0 initiatives. In this chapter, drawing on Rolandsson et al. (2019), we look more specifically at how different forms of digitalization in production, administration and communication have influenced competence requirements and demands for the reskilling, reorganization and upgrading of work among different categories of manufacturing workers.<sup>14</sup>

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14. Information about the company cases and the methodology applied can be found in Appendix 5 and in Rolandsson et al. (2019).

## Background and analytical perspectives

Nordic manufacturing is renowned for its high rate of technological innovation, rationalization and productivity growth through co-operation and employee involvement. Hand in hand with restructuring and internationalization, new technology and automation have continuously replaced labour intensive, primarily male-dominated parts of production. As shown by Berglund et al. (2020), this has been mirrored in job decline in manufacturing occupations such as "assemblers", "transport and storage laborers", "material recording and transport clerks", "machinery mechanics" and "blacksmiths and toolmakers", while there has been a steady increase in the number of "physical and engineering science technicians" and "software and computer professionals". As labour-intensive production and jobs have moved abroad, national headquarters and Nordic sites have concentrated on developing advanced, high value-added products. This development is evident if we look at changes in manufacturing employment. In 1980, for instance, manufacturing accounted for more than one out of four jobs (25–26%) in Sweden and Finland and for one out of five jobs (19–20%) in Denmark and Norway. Since 1980, the value added of Nordic manufacturing production has more than doubled, whereas the number of jobs decreased by around 40% by 2017 (OECD, 2017; nordicstatistics.org). In parallel, job growth in services has far exceeded the decline in manufacturing – contributing to substantial rises in employment – implying that manufacturing by 2017 only accounted for 13% of employment in Finland, 11% in Sweden, 10% in Denmark and 8% in Norway (Nordicstatistics.org). Figure 4.1 shows the development in the number of manufacturing jobs in each of the Nordic countries.



**Figure 4.1: Manufacturing employment in the Nordic countries 2000–2019, thousands (OECD.stat National accounts)**

Although the figure indicates that manufacturing has been subject to continuous technological rationalization, recent research points at manufacturing as one of the domains where digital technology is likely to have the most pervasive impact on the

organization of production and volume of jobs in the future (Fernández-Macías et al., 2018). Grouped under the heading of Industry 4.0, a number of studies describe how advanced or smart robots, networked machines, additive manufacturing, machine learning, the Internet of things, etc., transform production and work organization in manufacturing (ibid., Federal Ministry of Labour and Social Affairs, 2017; Barneveld and Jansson, 2017; Dølvik and Steen, 2018). This change can be linked with broader transformations involving, for instance, the green shift, which are said to accelerate the emergence of digital and more sustainable forms of production (Dieppe et al., 2020). Some authors also foresee dramatic changes, amounting to a Fourth Industrial Revolution that displaces industrial jobs at an unprecedented rate (McAfee and Brynjolfsson, 2014; Schwab, 2016). These studies depict advanced digital technologies with the potential to replace skilled staff increasingly rapidly, making up to more than half of all manufacturing jobs redundant (Fölster, 2014; Pajarinen, 2015; Böckermann, 2018). Digitalization might thereby also disrupt many of the previously described processes of SBTC (cf. Frey and Osborne, 2017), underpinning the processes of occupational upgrading referred to in Chapter 3. Other studies, however, depict a much less dramatic impact from technological development, but emphasize the pressure on the continuous upgrading of jobs and workforce skills. For instance, a recent OECD estimation based on analyses of work tasks suggests that around 14% of jobs in the OECD area as a whole and 7–10% in the Nordic countries will be affected (Arntz et al., 2016; OECD, 2018; Nedelkoska and Quitini, 2018). Likewise, a report from the World Economic Forum (2018, see also 2016), adopting a short-medium term perspective, argues that the creation of new jobs needed to accomplish the digital shift is likely to generate increasing demands for labour in manufacturing in Europe from 2018 to 2023.

All the machinery production sites analysed in this study are part of established multinational corporations with well-developed international value chains. As classic-style industrial actors turning raw materials or rough parts into sophisticated physical and mechanical products, they utilize advanced digital technologies associated with Industry 4.0 initiatives – such as robotics, artificial intelligence (AI), virtual reality applications, smartphones and networked sensors – to renew their organization of production and work. In doing so, they draw on accumulated know-how – in some instances, spanning more than a hundred years – on how to manage technological shifts in production, work organization and skill requirements. Exploring how they handle these challenges, and whether and how they involve labour representatives in social dialogue to resolve them, we draw on the discussion about upgrading in the previous chapter and ask what types of skills and competences the companies prioritize and deprioritize when they implement these new digital solutions. To illuminate these questions, the analysis distinguishes three forms of digitalization outlined in the subsequent section, each linked with distinct consequences for the reshaping of skills.

### **Skills and different forms of digitalization**

While much research describes how repetitive routine work is substituted by digital solutions, new digital technology can also act, in many instances, as a complement to employees' skills and competences. Thus, digital technologies may even serve as vehicles for upskilling and the potential upgrading of work (Anderson, 2008; Lanvin

and Kralik, 2009; Kefela, 2010). As routine hands-on tasks become obsolete, workers' capacity to perform specific tasks will depend increasingly on their cognitive ability to identify knowledge in extensive amounts of available information and apply such knowledge at work effectively (so-called hard cognitive skills). This type of upskilling recurrently blurs the demarcation between blue- and white-collar work and is often associated with rising demand for a broader set of softer so-called "twenty-first-century skills", including collaboration, communication, digital literacy, problem-solving, critical thinking and creativity (Voogt and Roblin, 2012; Van Laar et al., 2017). To detect how company actors respond to the changing organizational demands for such skills arising from digitalization, we distinguish between three forms of digitalization, notably digitalization of production, administration and communication, which tend to have distinct consequences for different employee groups.

The *digitalization of production* refers to processes involving, for instance, automation and robotization, pursuing efficiency by rearranging the way employees execute work tasks to be performed in accordance with a standard plan at a cost as low as possible. Standards and tight managerial control play a crucial role in such streamlined processes, rendering certain skills and jobs obsolete (Frey and Osborne, 2017) and fostering concern for growing job displacement and unemployment (SOU, 2017; Wacjman, 2017). At the same time, many of the employees that maintain their work will face increasing demands for so-called "hard" cognitive skills to perform well-defined tasks or activities. The digitalization of production may also lead to the removal of many heavy and ergonomically hazardous tasks, helping to bring about improvements in the physical working environment as well as occupational safety and health (Teece, 2007; Rüssmann et al., 2015; OECD, 2018).

The *digitalization of administration* refers to how organizations deal with the potential of digital technologies to register, store and handle client data. This type of digitalization often supports management and constrains white-collar employees' autonomy at work (Buffat, 2015; Busch and Henriksen, 2018). Computerized administration may replace staff and make many skills obsolete, for instance, by allowing customers to book appointments over the Internet and monitor their own orders from a distance (Manyika et al., 2017). Compared with the previous form, the digitalization of administration draws on digital infrastructures or information systems that continuously require staffs to update their digital competence and ability to apply new software (Bovens and Zouridis, 2002), i.e. "hard" cognitive skills associated with the performance of well-defined administrative tasks. The emerging administrative infrastructures may facilitate outsourcing as well as digital surveillance and control over local work practices and client communication across geographical boundaries (Jorna and Wagenaar, 2007; Buffat, 2015). In manufacturing, networked sensors and smartphones, machines and software also raise demand for staff with competence to collect, survey and administrate customer data, and in some cases, develop customized services that require more soft, interactive skills (Scholten, 2017; SOU, 2017; Fernandés-Macias, 2019).

Lastly, we talk of the *digitalization of communication*, which is motivated by the importance of knowledge-sharing, professional "community" collaboration and, in some cases, market-driven matchmaking (West and Lakhani, 2008; Pongratz, 2018). Digitalization in these cases draws on the use of network technologies that enhance organizational flexibility and demand complex combinations of both "soft" and "hard" skills supporting product development, teamwork, innovation and other forms



of adaption to changing markets (Kallinikos, 2012; Treem and Leonardi, 2012). Digital networks provide opportunities to mobilize widespread and complex combinations of resources that enhance flexibility, creativity and/or customization. In manufacturing, this type of digitalization often links conventional production with the development of new and tailored services (Demil and Lecocq, 2006; Rolandsson et al., 2011). At the same time, employers and employees face changing demands for competence development, security management, maintenance and quality issues. Development of "soft" interactive skills are often the focus, but constant adaption and reskilling may also increase the level of work-related stress and cognitive health and safety concerns. Furthermore, employees may have to deal with the fact that the digitalization of communication enables employers to reduce their dependency on their existing workforce via inter-organizational collaboration or the outsourcing of work to digital platforms (Ågerfalk and Fitzgerald, 2008).

## 4.2 Findings – Exploring digitalization in Nordic manufacturing

In this section, we review the findings of our exploratory study, focusing on the drivers and motives for digitalization in manufacturing, and the possible impact on competence requirements, the division of labour, work organization and employment relations.

### Motives for digitalization

To begin with, the overarching motives for digitalization were common to all the studied companies, notably to enhance their ability to cope with increased international competition through the minimization of costs and innovation of products and product quality. The companies pursue these aims by combining efficiency-enhancing automation and technical rationalization of production with the implementation of communication and information solutions supporting the development of new products and services. These efforts often involve the introduction of new production concepts characterized by catchwords such as "adaptivity", "agility", "lean" or "servitization", with the aim of improving the plants' ability to solve problems, tailor products and innovate in response to changing market and customer demands.

Digitalization in the studied cases is often associated with different degrees of automation of the manufacturing process, involving robots for instance, in combination with the development of more or less digitalized wider value chains. Their approaches to digitalization differ in relation to which parts of the organization – production, administration or communication – their digitalization efforts are directed at. In production, efficiency is pursued primarily by replacing the manual conduct of work tasks with digital solutions. Here, quality issues and the high cost of labour are often cited as the main incentives to invest in new technology and automation. Besides these incentives, the associated productivity and efficiency gains, positive financial investment returns and removal of health and safety risks are cited as drivers for digitalization. One Danish management representative explains:

*If you need to automate an assembly line, it needs to be profitable to make such investments... Here it is pivotal that you get more efficient productivity, it has to increase while your production costs decrease. It is also a matter of having the possibility to set up a robot in places where historically there has been a person producing exactly the same thing, but with negative implications for their health and safety. However, it is not everything that can be automated and that is especially true in case of some of the more complex things. (Dk2: Management representative).*

Digital solutions in administration and communication often converge or support each other. In some instances, they are also closely tied to the digitalization of production, for example, aiming to improve assembly line operations by involving digital communication devices such as smartwatches, iPhones, plasma screens, etc., and in this way, easing communication between employees as well as management and the shop floor. Here, digitalization acts as a tool to improve knowledge-sharing and communication management, demanding "soft" interactive skills in complex company contexts that involve employees at many different sites, often globally located in different time zones. Joint information systems also enable the recycling of information, making it possible to manage the time delays and quality risks characteristic of manual documentation and the transfer of products and production data. The quickened exchange of information can also contribute to more resource-efficient production.

Furthermore, digital information and communication systems that enhance data gathering and analysis play a crucial role in securing product quality and augmenting the companies' capacity to plan, foresee and improve both process and product adjustments. For instance, the interviewees in one of the companies referred to the importance of introducing sensors in the components, which improve the ability of the manufacturers to stay connected with their products while being in use and make it possible to tailor both products and services more effectively in accordance with customer needs.

### **Consequences for competence requirements and division of labour**

Given the aforementioned motives for digitalization in the companies, some consequences fall natural and expected. Reportedly, digital solutions in the production processes not only lead to more resource-efficient production by drawing on less manual work, but also create expectations that all parts of the work organization are involved in production monitoring and quality control, requiring more cognitive skills among the employees executing the tasks. As elaborated below, the evolution of such high-involvement organizations is associated with a flattening of hierarchies and less strict division of labour between different occupations. In addition, there are a number of indirect consequences not as clearly related to the motives for digitalization. For instance, whereas blue-collar workers (e.g. operators, truck drivers) requiring upskilling are usually provided with organized educational support, white-collar workers (in particular engineers, but also middle-level managers) often experience increased individual responsibility for their own competence development. The interviewees also report that digitalization affects the working environment and workers' health in ambiguous ways. For instance,

digital devices not only replace hard physical work, ease the maintenance of the assembly line and provide more autonomy for blue-collar workers in particular, but also can foster cognitive stress because of the more demanding management of information and broadened responsibilities (cf. Christensen et al., 2019).

In some cases, concern or even resistance can be identified, particularly among blue-collar workers. All interviewees also describe how different forms of digitalized production over the years, often in combination with the outsourcing of work tasks, have reduced the number of unskilled blue-collar jobs at the studied production sites. This is especially true concerning the early years of the digitalization of production. Depending on the development in production, the recruitment of white-collar expertise and home-shoring, however, the impact on the total number of jobs varies among the companies. In one of the Danish companies, the introduction of advanced digital technologies has enabled it to retract part of its production from abroad as its domestic sites are now able to make products with lower costs and higher quality than its sites in low-cost countries. Combined with rapid growth rates, this has enabled several of the companies to retain workplaces and thus even out the potential loss of workplaces arising from the labour-saving digital rationalization of production. Other companies describe how personnel have been reallocated to new tasks, and how labour with new skills has been recruited in parallel with the retirement of labour with outdated competences that are not replaced. The continuous updates in technology and manufacturing processes nevertheless require that the companies retain some of the old staff with specific expertise to be able to maintain production while introducing the new systems. A shop steward at one of the Finnish companies explains:

*Many machines can now be driven without manning. Other reasons for using computer-controlled machines include the opportunity for multi-machine use and occupational safety. Manual machines are no longer used in actual production of new products. They are only used for making spare parts, repairs, factory service and tooling and fastening. Machinists make programs themselves. There is a special group of workers in the "attic" who actually do these programs and run the machines themselves. (Fin2: Head shop steward)*

Though production in general becomes less dependent on hands-on operations, several interviewees stressed the importance of continuity by underscoring that certain hands-on skills are still needed. In addition, the shortage of adequately skilled labour supply amplifies the demands for upskilling and the reallocation of labour already present within firms.

Moreover, some of the interviewees highlighted that digital technologies enable the externalization of blue-collar labour and tasks to be transferred to subcontractors or temporary work agencies (Goos et al., 2014; Oldenski, 2014; EU, 2015). This was also one amongst several explicit strategies in, for instance, the Danish and one of the Finnish companies where, in particular, low-skilled blue-collar work was outsourced to sites in low-cost countries. Although the contractual status of staff thereby changes, such solutions still depend on human labour, and thus diverge from solutions based on the technological capacity to replace blue-collar workers. In the two Swedish firms and one of the Norwegian firms, by contrast, both management

and labour representatives emphasized that their companies seek to abstain from using consultants, staffing companies or other contractual arrangements based on nonstandard employment. By reducing their dependence on buffers of flexible, casual labour and concentrating on the development of their own internal core staff, interviewees from these companies claimed that it became easier for them to control the acquired competence and allocation of staff.

Through reallocation, workers are assigned new tasks, sometimes in new occupational roles. Especially in the case of blue-collar staff who conduct fewer skill-demanding tasks, this allows or enforces them to engage in cognitively more demanding work tasks, for instance, the surveillance and maintenance of the production process. Such tasks raise the demands for what we have previously referred to as "hard" cognitive skills and may require programming skills and the ability to detect digital errors that cause interruptions in production. A group manager in one of the Swedish companies explains that both the individual and the company gain from such reallocation:

*Our challenge is that we have to become more efficient, and sometimes the most efficient way to develop mentally, what we have done is..., at first we are not replacing people because in total we have enough bodies. I am sure of that, but they are just in the wrong places. What we have gotten to now is if someone will leave, I move some people around, and I change a little in what they work with. Two things have come out of it; one, we have become far more efficient, and two, we have actually blossomed people's careers by doing that. Persons are being challenged and are enabled to see things differently. (Swe1: Group Manager Sales).*

So-called "smart maintenance" that draws on different forms of both production and network technology demands that white- as well as blue-collar workers in these cases acquire the ability to scrutinize data and engage in programming. For the blue-collar workers, the digitalized production processes also require that they increasingly make sure that task execution takes place in a correct way precisely according to the book. In some cases, they also need to consider that they may have to engage in hands-on tasks. For instance, one of the shop stewards described how auto trucks will not function correctly, if goods are initially misplaced.

### **Consequences for the organization of work**

Digitalization manifests itself in the manufacturing companies in a countless number of continuous incremental improvements rather than giant leaps. Contrary to the narrative that digitalization disrupts most former boundaries or completely turns previous modes of work upside down, it is associated with the ongoing rationalization of production, administration and communication, constantly requiring renewal of skills, work tasks and work organization. These changes also open opportunities to flatten hierarchies, decentralize responsibility, reorganize work in (autonomous) teams, enhance job rotation or engage in other more inclusive, peer-based forms of collaboration. Some of the interviewees also described how the digitalization of communication and administration provides new ways of organizing and leading work that are associated with increased opportunities to outsource

parts of production. The interviewees from the Finnish vehicle producer, for instance, described that the company primarily engages in the upskilling of white-collar staff in product design, while they have outsourced most of their blue-collar tasks. Renewal is largely perceived as a matter of providing white-collar staff with new softer competences needed for product customization and innovation, while the remaining blue-collar workers continue conducting similar tasks as prior to the latest twist of digitalization.

All companies, however, urge employees to develop their skills. They invest in the upskilling of their own staff as a response to the increased technological complexity needed for exploiting the productivity-enhancing potential of new digital technologies. In the case of blue-collar workers, the emphasis on upskilling often comes with broader responsibilities, job enrichment and opportunities for increased autonomy. The interviewee in one of the Norwegian cases explains:

*The role of an operator is increasingly the role of a systems operator. Our operators become increasingly "light blue", the distinction [between blue- and white-collar workers] is being blurred. Engineers do some operator tasks, while operators do engineering tasks. Co-operation between the different groups of employees has previously been difficult, partly because of resistance from the unions, but this has really changed. Everyone understands that we cannot be fractioned and that we have to work together to be a good and competitive firm. Many operators now do what was considered engineering tasks, it is quite a big shift. (Nor1: Director, Research and Technology)*

The quote implies that changes, in many cases, are more profound for blue-collar work. Because of the new work tasks and competence demands of blue-collar workers, many previously clear distinctions between white- and blue-collar jobs become blurred. Hence, several interviewees maintained that occupational health and safety aspects in the work of blue-collar workers have become more similar to those of white-collar workers, as digitalized processes enable cleaner and safer working environments and reduce heavy and repetitive work tasks. As a corollary, blue-collar workers are increasingly exposed to new forms of health problems, for example, those related to terminal work and cognitive stress. At the same time, new digitalized ways of measuring performance and productivity also enable new forms of management control that, according to the shop stewards, cause concern primarily amongst white-collar workers. While some interviewees reported that white-collar workers at their company had rarely been subject to the same level of quality and performance control as blue-collar workers in the past, a series of new digital tools make it possible for management to apply "lean" concepts and control all levels within the company in more systematic ways.

### **The meaning of upgrading and consequences for management–labour relations**

The observation that digitalization contributes to vaguer boundaries between white- and blue-collar work resonates with several studies on the topic stretching back through history (IF Metall, 1985, 2017; Rolandsson, 2003). According to our interviewees, the upgrading of skills and more blurred interfaces between blue- and white-collar workers have implications for employment relations and how the unions

operate. In particular, they describe how such changes can undermine conventional demarcations between unions representing different occupational groups. Even the largest blue- and white-collar unions in one of the Swedish companies state that they collaborate more extensively (Rolandsson et al., 2019). While union representatives on the national level are sometimes sceptical towards such rapprochement, the local actors expressed that they share similar concerns for e.g. job quality, upskilling and the working environment, which makes it natural for them to co-operate.

Still, our study indicates that blue- and white-collar workers face partly different demands for reskilling, potentially facilitating different forms of upgrading. Blue-collar workers primarily encounter upskilling demands due to the digitalization of production, where new technologies not only rationalize blue-collar work tasks and enhance efficiency, but also often require the integration of tasks and responsibilities that bolsters the autonomy and voice of the operators on the shop floor (Frey and Osborne, 2017). Hence, company-sponsored courses and educational measures acquired from vocational schools, technical colleagues, local universities or other awarders of degrees are frequently offered to blue-collar staffs as a means of upgrading their cognitive skills and acquiring more qualified tasks (Teece, 2007; Rüssmann et al., 2015). Upskilling in this way may also, in some cases, lead to changes in their position in the occupational structure and strengthen their influence on developments in employment relations.

At the same time, the interviewees expected new forms of virtual real-time training to play a more prominent role in the upskilling of both blue- and white-collar workers. Yet, upskilling among white-collar workers seems bent more towards the digitalization of communication and administration, demanding competences to manage complex processes of innovation, product development and the identification of changes in delivery flows across business operations. Rather than upgrading the position of white-collar workers in the occupational structure, this type of digitalization requires that they, as individuals, keep themselves updated. This can be done, for instance, through various e-learning initiatives that help them meet occasional new competence demands arising from new software or other changes in products and production. As it varies how organizational changes driven by new technological solutions affect their work tasks and the needs for skills updating, the consequences of digitalization also appear to be less obvious for white-collar workers. Hence, the Danish companies in our sample changed their recruitment strategies targeted at specific white-collar expertise by increasingly relying on specialised consultants, investing in small startups and hosting workshops with highly specialised entrepreneurs, rather than upskilling the expertise of their own specialists.

Some white-collar union interviewees were also rather critical and stressed that employers in the future will have to engage much more in the further education of white-collar staffs. They believe that advanced forms of the digitalization of production (involving increasingly more AI) will become even more pervasive and also affect white-collar work tasks. By rationalizing skilled white-collar work, this type of digitalization might halt the generation of tasks that otherwise would provide opportunities for blue-collar workers to upgrade their work and reduce the number of qualified jobs available for white-collar employees in the future, even if they continuously update their skills.

In dealing with the challenges of digitalization, both the union and employer interviewees emphasized that they are able to discuss these type of problems with each other. They appreciated the Nordic tradition of social dialogue and institutional arrangements that facilitate local collaboration and joint problem-solving between employers and unions. In the context of digital change, this type of dialogue was crucial for them to identify needs for educational and organizational measures to facilitate upgrading of broader groups of the staff and ways to encourage individuals to update their skills continuously, i.e. echoing the broader public discussion on life-long learning. Existing measures that they had agreed on involved, for instance, collaboration with technical colleges and vocational schools, the validation of industry-specific competence, organized e-learning initiatives, virtual reality training, the digital training of apprentices and collaboration with local universities.

### **4.3 Summary – Upgrading the occupational position or updating required competences**

Digitalization, as it manifests itself in the studied cases of Nordic manufacturing industry, does not give much support to the narrative of disruptive change that features high in the literature on digital technology (Frey and Osborne, 2017; Wacjman, 2017). All the investigated cases engage with digitalization initiatives that can be described as Industry 4.0 projects. Yet, none of the interviewees indicate that they struggle with the demise of work or dynamics of change that polarize or degrade work, undermining the opportunities to upgrade blue-collar manufacturing jobs. Concern or even resistance occur, and there is clearly a continuation of the long-standing decrease in the number of blue-collar jobs – especially unskilled jobs – but in line with the idea of SBTC (Berglund et al., 2020), the interviewees rather view digitalization as a driver of further upskilling and upgrading of manufacturing work.

The companies' request for upskilling echoes the long tradition of Nordic "high-road" labour markets and techno-optimism, where all parties, including the representatives of unions and distinct employee groups, tend to have positive expectations towards new technologies and encourage their introduction (Rolandsson, 2003; Dølvik and Steen, 2018). However, rather than regarding digitalization as a uniform force, the distinction made between the digitalization of production, administration and communication revealed clear variation in how representatives of blue- and white-collar workers view the demands for upskilling and upgrading of work. Ideally, the analysis discerns two conceptual frames comprising different forms of digitalization that are related to different dynamics of upskilling that may underpin upgrading in quite different ways (Table 4.1).

#### Blue-collar workers

Upskilling that supports upgrading of their position in the occupational structure and work organization.

Digitalization of production

– Automating jobs conducted hands-on/physically hard work, but fostering new forms of cognitive stress.

– Demanding new digital/cognitive skills, while making some (manual) skills obsolete.

– Demanding cognitive abilities to identify key information and applying it effectively in production.

Digitalization of administration and communication

– Outsourcing low-skilled blue-collar tasks.

#### White-collar workers

Upskilling in terms of updating the competences needed for the pursuit of an individual job.

Digitalization of production/product development

– Demanding closer collaboration with shop floor operators.

Digitalization of communication

– Supporting functional flexibility

– Demanding continuously updated skills and information management.

– Fostering concerns for cognitive stress.

Digitalization of administration

–Introducing performance control and servitization.

**Table 4.1: Two frames of upskilling due to the digitalization of work**

In practice, the different forms of digitalization are obviously entangled, fostering a variety of complex and interconnected combinations in each case. Nonetheless, while blue-collar workers are primarily exposed to the digitalization of production, rendering some of their former hands-on tasks obsolete, at the same time, they face a better physical working environment and new tasks that demand “hard” cognitive skills. To be able to catch up with this transformation, blue-collar workers in general are also involved in organized measures, involving training and the co-ordinated reorganization of work – often entailing broader responsibilities – settled in negotiations between the union and the employer. They may face new types of cognitive stress, but by taking part in training, new forms of teamwork and increasingly with traditional white-collar tasks that demand cognitive skills, blue-collar workers have opportunities to upgrade the content of their work and their position in the occupational structure.

For white-collar workers, however, digitalization is associated with various forms of digitalized communication and administration, requiring involvement in knowledge-sharing, information management, servitization, product development and innovation activities. In doing so, they are compelled to update their cognitive skills (often based on soft or interactive aptitudes) to be able to cope as individuals with the constant flow of change in their work tasks, but they do not usually improve their position in the occupational structure and sometimes even have to cede tasks to the shop floor operators.

Such divergence in the way blue- and white-collar workers are exposed and respond to different types of digitalization obviously raises questions about what upskilling and upgrading actually means for different categories of workers. An important result of this study is thus that we cannot solely resort to general definitions of digitalization. Indeed, there is a need for more in-depth studies looking more closely at what types of digital tasks different groups of employees actually engage in and how their job quality, working environment and employment relations are affected in order to understand fully what upgrading means to industrial practices reshaped by Industry 4.0. While answering such questions, we may also recall that this chapter looked into a male-dominated work domain, which provides reasons to look deeper



into gender differences. New forms of digital production responding to broader demands for a green shift, or even to the consequences of the recent COVID-19 pandemic (Dieppe et al., 2020), will most certainly require such studies in the future.

# Chapter 5: Digitalization of services - A diverse picture

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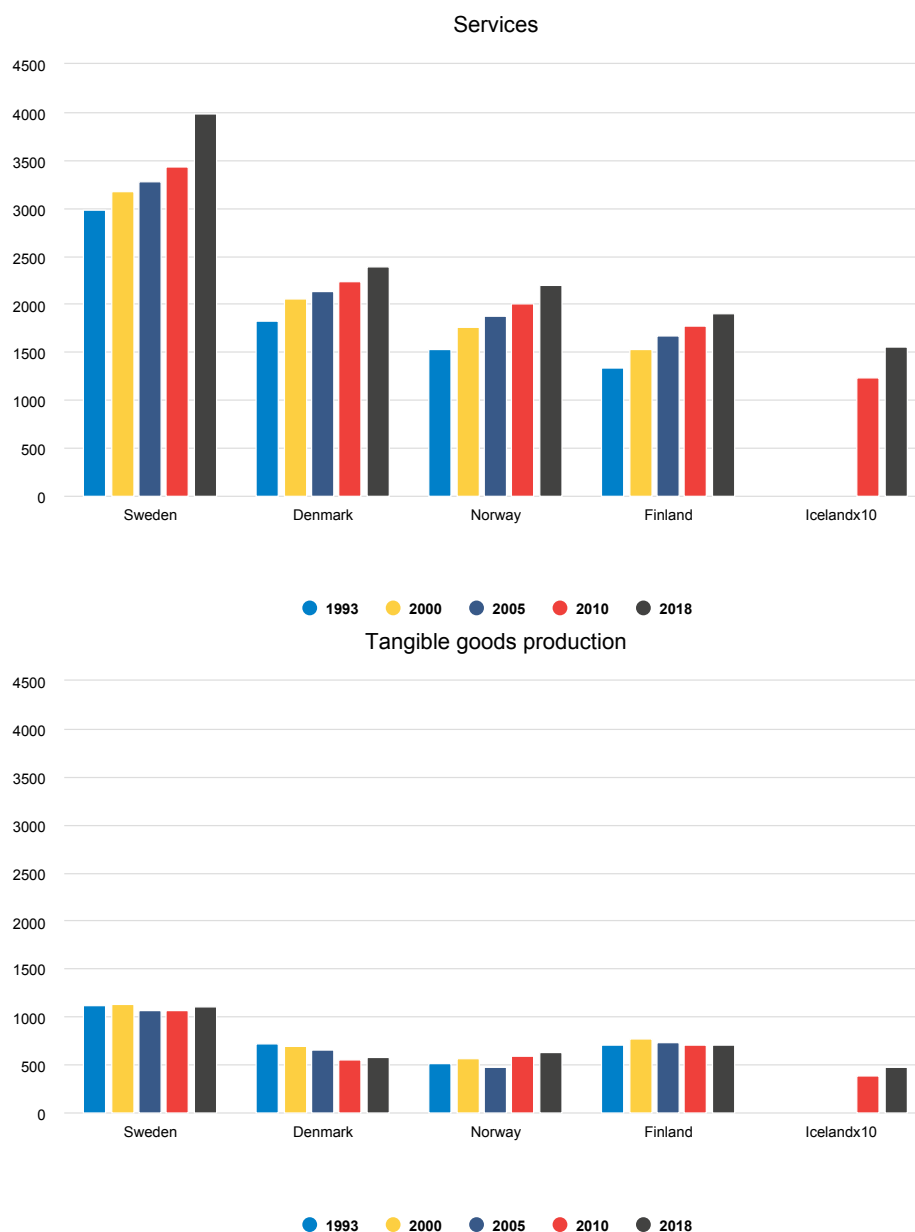
## 5.1 Introduction

The Nordic countries were early movers into the post-industrial society, propelled by the development of large public services sectors with high shares of female employees. Already in 1990, the services sector accounted for around 70% of Nordic employment, and today, almost four out of five workers are employed in the services sector. The share is higher among women and somewhat lower among men. In this chapter, we discuss how digital technological change may affect service work and employment. The notion of services applied in this chapter follows the conventional international classification of industries (NACE-codes, 1 digit), where economic activities are categorized according to their main end-product (i.e. goods or services) (Eurostat, 2020). That is, entities that produce tangible goods are placed in either the primary sector (e.g. agriculture, fisheries) or the secondary sector (e.g. manufacturing, construction, mining, energy), while all other entities providing intangible services (e.g. health, education, finance, legal advice, sales, transport, lodging, restaurants, research) are placed in the so-called tertiary sector, which is interchangeably coined as the services sector. Therefore, the notion of service employment used here refers only to people employed in firms/entities generating services, and does not include workers employed in e.g. a manufacturing or agricultural company performing service tasks such as accounting, cleaning or clerical work.

Section 5.2 provides an introductory overview of the services sectors in general, briefly referring to some of the scholarly debate regarding the drivers and particularities of service work and the potential impact of digital technological change on service employment. Encompassing four-fifths of the total labour market, the notion of services comprises a huge and highly diverse conglomerate of industries, branches and occupations with vastly different potentials for digitalization. In Section 5.3, the text zooms in on the diverse experiences with digitalization in three quite different service industries, i.e. retail, elderly care and banking. Section 5.4 summarizes the main findings.

## 5.2 Background and overview: Trends in service employment

Introducing some general features characterizing the services sectors, we start by looking at long-term trends in services employment and the main drivers behind the persistent growth in service work. As seen in Figure 5.1, employment in the services sector has continued to rise in the twenty-first century, and since 2000, almost all net job growth in the Nordic countries has come in the services sector.



**Figure 5.1: Change in employment in services and the production of tangible goods, including construction, in the Nordic countries, 1993–2018. Employed persons in thousands (OECD.stat National Accounts)**

Comprising high-skill occupations in both business and public services, routine-based occupations in the middle end and low-skill, non-routine jobs in the lower end, one would, as discussed in Chapter 3, expect the services sector to be a prime example of polarization. However, in the period 2000–2015, the services sectors in Norway, Sweden and Finland showed clear upgrading of the job structure, with virtually all job growth being concentrated in the upper and middle layers of the occupational ladder. In Denmark, the services sector instead showed signs of polarization with somewhat more job growth in the low than in the middle end (Berglund et al., 2020). There is a belief that employment growth in services is necessarily accompanied by a rising share of low-skilled/low-paid jobs with a high incidence of nonstandard contracts (Ilsøe et al., 2020). Contrary to this belief, our findings suggest that a major share of the new jobs in services in recent years has come in occupations with decent wages and relatively high skill requirements – typically in public and business services. In contrast to the male dominance in the primary and secondary sectors, many of the high-skilled service occupations in the tertiary sector are either dominated by female employees or gender-balanced. If this tendency towards upgrading continues, however, a likely side effect is that in the future, there will be relatively fewer service jobs available for people with limited skills – making inclusion of, for instance, immigrants more challenging.

As seen in Figure 5.1, the pace of growth in service employment shows notable variations between the Nordic economies in recent years, ranging from 7% in Denmark and Finland to 10% in Norway, 16% in Sweden and 26% in Iceland in 2010–2018 (OECD.stat). These variations evidently have little to do with technology, but reflect national differences in economic growth after the financial crisis, when it took roughly a decade before total employment in Finland and Denmark reached pre-crisis levels.

Looking ahead, the relative importance of employment in services is likely to continue rising in the coming decades as well, as the technological transformation in manufacturing and other industry branches is expected to cause further employment decline there (see Chapter 4). For the large majority of the Nordic labour force, the future of work will therefore depend on what happens in the variegated services sector when the spread of digital technologies picks up after the coronavirus pandemic, which by the time of writing this report, has pulled the rug out from under many service jobs. In parallel, however, ageing and the foreseen shift to a greener economy are likely to propel increased demand for many social and personal services (Dølvik and Steen, 2018).

### **Nature and particularities of the services sector**

In traditional economic thought, the provision of services was mainly considered as an appendix to the value-adding production of goods in manufacturing in particular. Associated with transport, circulation and distribution of tangible goods, the notion of services or the tertiary sector was negatively defined as all activities that did not belong to the primary and secondary sectors (Fisher, 1939), lumping together all the intangible tasks that were needed to reproduce the industrial workforce and make society and the economy go around. Expressed in the truism that “we cannot live by cutting each other’s hair”, service work was conceived of as an intermediary cost factor that detracted from the value added generated in the production of “real goods” and did not contribute much to economic productivity.

In the 1970s, post-industrial theorists challenged this view and argued that developed industrial nations were entering a new era in which the creation of economic added value was driven by the demand for services, information, knowledge and other intangible end-products (Touraine, 1971; Bell, 1973; Castells, 2000). That is still a contested proposition, as it has become clear that economic growth remains highly reliant on developments in the traded goods sectors. Especially, the growing business services are, to a large extent, servicing the production, financing, transport/logistics and distribution of industrial goods, and are undertaking support and development functions that, in line with the increased focus on "core business", have been outsourced from the industry sector (Van Neuss, 2019) (see also Chapter 4). According to a study in USA, such blurring of sectoral boundaries accounts for more than one-third of the growth in service employment in the post-war era (Berlingieri, 2014). As also expressed in the notion of the emerging "manuservice" economy (Bryson and Daniels, 2010), it seems both that the demand for goods and services is highly interdependent and that the provision of services is not replacing, but rather, complementing the production of goods as the *raison d'être* of economic activity in contemporary capitalism (OECD, 2000; Dølvik, 2001).

To understand how these changes involve different patterns of innovation, the huge diversity of the expanding services sector must be kept in mind. For instance, research distinguishes between services that serve different economic functions and user groups (customers), such as *producer services* (firms furnishing business with a variety of support functions, e.g. accountants, consultants, finance), *distributive services* (e.g. transport, logistics, trade), *personal services* (e.g. hair-stylists, hotels and restaurants) and *social services* (Elfring, 1988). While the former two are predominantly oriented towards business customers, the latter two provide end services mainly consumed by households or individuals (OECD, 2000), implying that the sources of demand, the price sensitivity of customers, and hence, the drivers of growth vary significantly. So also do the labour, skills, equipment and facilities needed to accomplish the services, indicating that the potentials for technological innovation, rationalization and job growth differ accordingly.

### Services sector growth and productivity

Regarding growth in the *demand for services*, producer and distributive services predominantly depend on developments in the business markets, that is, on the rate of economic growth and extent of outsourcing of services formerly provided in-house in the industrial sectors. While the price sensitivity of demand for such business services tends to be low, the demand for personal and social services is usually more price-sensitive, as it depends on the purchasing power and preferences of individuals and households. Employment growth in personal and social services is therefore more dependent on societal factors such as the level of living conditions, income inequality, welfare arrangements and public policies.

In the long-term perspective, advanced industrialized countries have seen that the population's propensity to demand more personal and social services has increased steadily with rising living standards (so-called Engel's Law; Pasinetti, 1981). Analogous to psychological theories of the hierarchies of human needs (Maslow, 1943), it stipulates that the higher the income, the greater the share people will spend on more elevated products/goods, such as culture and education. Even today, it is evident that the wealthier citizens of the world spend a higher share of their expenses on individual services, travel, health and leisure than do less well-off people.

On the other hand, as pointed out by Keynes, the propensity to save also increases strongly with income, implying, *ceteris paribus*, that the higher the share of income going to the richer groups of society, the less the demand for goods and services in the national economy will grow.<sup>15</sup> Therefore, while rising general living standards tends to boost the population's demand for personal and social services, rising inequalities tend to restrain growth in the demand for such services.<sup>16</sup>

The main explanation of the long-term rise in service employment is offered by the Baumol theory of service "cost disease", based on the assumption of intrinsically slower productivity growth in services than in the production of goods (Baumol, 1967). Considered as less apt to technological rationalization and more reliant on personal interaction with the customer, many services are time- and space-bound, cannot be stored and have been perceived as unalterably labour-intensive. The gist of Baumol's theory is that if wage costs in the services sector are not attuned to the lower level of productivity than in other sectors, the result will be prices rising to a level that is affordable by very few customers. Thus, if service production and employment is to continue flourishing, societies seem left with two options: either allowing growing inequality of wages between workers in services with low productivity and other activities, or subsidizing the price of such services through tax deductions or tax-financed direct public provision (Dølvik, 2001).

While very few would deny the relevance of the Baumol effect, a lot of attention has been paid to the difficulty of measuring labour productivity in services (Romer, 1987; Schmid, 2000; Storrie, 2000). Not only have services become a more important determinant of productivity in other sectors, but also the pace of technological innovation has made clear that the potential for productivity growth in many services is much greater than that often previously assumed. An obvious case in point is the growth of computer-based services in banking, insurance and commerce, as well as other business-related activities, which have also paved the way for the rising trade in services via the Internet and the mushrooming platform economy (see Jesnes et al., 2020). Also, in fields such as culture, health, information and distribution, new technology has opened amazing opportunities, further accentuating the links between growth in services and traded goods, especially in the digital devices and software industry. Already 20 years ago, studies from Sweden and Germany reported that capital intensity in many private services was higher than that in industry, and that labour productivity was rapidly growing (Bosch, 2001; Murhem, 2001). These trends have taken new twists in recent years, where for instance, the production and dissemination of knowledge/information and entertainment services have been revolutionized and marginal unit costs brought down towards zero, implying not only increasing returns to scale, but also the forceful "winner takes all" dynamics witnessed in parts of the infotainment industry. Also, the labour-saving potentials of the digital transformation in producer and distributive services are undisputable – as witnessed in the automation of manual tasks in finance, accounting, wholesale, logistics, transport and so forth – implying that strong growth in demand is needed to keep up employment there, and that substantial change in the organization of work and the occupational and skill structure is to be expected (see the sections on retail and banking below).

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15. This tendency is magnified by the higher propensity among affluent groups to move parts of their consumption, income and wealth abroad, thereby also reducing domestic tax revenues.

16. The possible exception is the so-called "conspicuous consumption" of "luxury goods", whereby affluent groups seek to distinguish themselves from ordinary people (see Veblen, 1932). A topical question though is to what extent the consumption of certain personal services – be it domestic cleaning, gardening, personal trainers or particular leisure activities – is still regarded as a luxury in the Nordic countries. If so, rising inequality is likely to boost demand, and if not, rising inequality may well restrain employment growth in such branches.

However, in large parts of personal and social services with many female workers, the prospects for technological innovation and the rationalization of work processes are far more uncertain. Although the rate of technological innovation in health, care and education bodes well for substantial process rationalization, implying that more and better services can be provided by the same input of human resources (HR), the essence and quality of most social and personal services ultimately depend on the interaction between the client/customer and the service provider. This is perhaps most clearly illustrated in the case of elderly care (see below), where for instance, monitoring technologies can make some work tasks easier and faster, but it is difficult to envisage that the demand for human presence in catering to the needs of ailing people is likely to change much. In a recent book titled *Why Computers Get Cheaper and Health Care Doesn't*, Baumol et al. (2012) suggest that the resources allotted to health and social services are bound to increase. The reason is simple: in the production of tangible goods, technological progress propels steady growth in productivity and wages and falling product prices. In labour-intensive health and social services, new technologies have more limited potential for productivity growth. Yet, to attract and retain labour, wages and labour costs need to increase in accordance with that of the manufacturing industries. Consequently, technological progress in the production of goods spurs rising costs for HR in health and social services, thereby increasing product prices.

In a world of almost jobless growth in industry, service "cost disease" and fiscal rectitude driven by tax competition and global finance, governments in advanced economies were, according to Iversen and Wren (1998), therefore facing a "services trilemma". The argument was that of the three policy objectives – fiscal rectitude, wage equalization and the expansion of service employment – only two goals could be successfully pursued at the same time. As fiscal rectitude was considered a given and the tax levels needed to fund public employment were hard to increase, the implication was, so the argument went, that governments could mainly choose between higher joblessness or more wage inequality aimed at boosting private service employment. The "trilemma" thesis has often been read as a warning, indicating that the Nordic model for creating post-industrial job growth – based on high tax revenues funding predominantly female employment in large public services sectors – was showing its limits (Dølvik, 2001). Hence, Esping-Andersen (1999) argued that the rising level of taxation required to absorb surplus labour through the expansion of subsidized public services was at odds with competitiveness in the global economy. Further, the egalitarian Nordic wage system was, in his view, blocking the creation of jobs and private services demanded by the increasing majority of dual-earner households, and women in particular, in the Nordic countries.

However, since the "services trilemma" thesis was launched around the turn of the century, development in Nordic service labour markets has shown that the triangle of conflicting goals implied by the "trilemma" were of a less rigid, absolute character than that envisaged at the time (see also Wren et al., 2013). Not only have the constraints of globalization – in terms of tax-funding sizable public sectors – proven less unequivocal than originally foreseen, but also, contrary to predictions, the Nordic countries have managed to steer a course that has fostered solid job growth in both private and public sector services over time while, at the same time, broadening the tax base, curbing the rise in taxation levels and maintaining international competitiveness. Moreover, as pointed out in Chapter 2, Sweden and Finland especially underwent information and communication technologies (ICT)-driven re-industrialization in the late 1990s and early 2000s, accompanied by rising exports of

advanced producer and business services with high wages and value added (Erixon, 2011; Vartiainen, 2011). Similar developments of advanced services have been seen in Denmark, for instance, related to windmill technology (Goul Andersen, 2011), and in Norway related to e.g. the maritime sector and sub-sea extraction of natural resources. Nonetheless, the trade-offs between job creation in less-skilled personal services and the equalization of wages highlighted by the "trilemma thesis" have clearly influenced developments in the Nordic service labour markets.

Aimed to stimulate employment, a range of policy measures have sought to lower labour costs, for instance, by means of tax deductions for employed people and for purchasers of domestic services, complemented by measures to lower job seekers' reservation wages through so-called in-work benefits and the retrenchment of welfare benefits – mostly by stealth. More leeway for nonstandard contracts and activation policies supported by various subsidies lowering labour costs in "entry jobs" for vulnerable groups have pulled in the same direction. Although the employment effects of all these measures are difficult to assess (Kvist and Pedersen, 2014), it is evident that Nordic employment in services has risen markedly since 2000. Wage inequalities have also risen, though at a very different pace, and not in ways indicating any simple correlation between increased wage inequality and services job creation.

The strongest job growth in services of the Scandinavian countries has in recent years taken place in Sweden, where wage inequalities have changed the least and remain the lowest in Europe. In parallel, Sweden has seen a persistent upgrading of the occupational/skill structure of employment. Even in services, job growth has been the strongest in the upper parts of the occupational ladder, marked by high levels of education and wages.<sup>17</sup> This is partly a reflection of growth in advanced, exportable services, where new technologies enable high productivity growth and the evasion of service cost disease (Baccaro and Pontusson, 2016), which is partly a reflection of the expansion of high-skilled jobs in public services and the strong performance of the Swedish economy, which has also ensured a rising demand for labour in less skill-demanding personal and social services (Dølvik, 2020 forthcoming). Conversely, the stagnant service employment seen during the slumps in Finland and Denmark after the financial crisis lends further support to the interpretation that, thus far, macro-economic performance has been more decisive than technological change in influencing the pace of service job creation in the Nordic countries. The burst of the coronavirus pandemic in 2020 has indeed demonstrated how dependent many service industries still are on direct interaction with the consumer/customer, but it has also sparked the innovative use of new digital technologies in providing services that may influence developments in the future.

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17. In fact, also in manufacturing and other tangible goods production, most job growth has come in high-skill occupations that mainly do various kinds of service/tertiary work, i.e. management, sales, marketing, human resource management, planning, project development, administration and so on (see Berglund et al., 2020).



## 5.3 Varieties of services digitalization

If we are to understand how digital technologies transform work and employment more broadly in the services sectors, we have to recognize the diversity of service industries and keep in mind that different services depend on a variety of client interaction, more or less time- and space-bound. The following section therefore looks closer at three examples of the digitalization of *retail*, *elderly care* and *banking* services. These three sectors allow us to explore the variegated patterns of digitalization in services. Retail, the biggest private service sector in terms of employment, is traditionally a time- and space-bound service, increasingly conducted online via new business models and with the aid of different labour-saving technologies. Representing social services rooted in the public sector, elderly care is a case where it is hard to envisage that the demand for human presence in catering to the needs of ailing people will be disrupted by digital technologies. Banking constitutes a case where companies offer services to both businesses and individual consumers, increasingly shaped by Internet-based financial services, the emergence of fintechs and a variety of high-tech intermediaries (Alt and Puschmann, 2012; Mollick, 2014). In all three examples, the quality of the services depends on interactions between the client/customer and service provider, though in retail and banking, are ever more often mediated through digital means (e.g. home banking). In elderly care and banking, the relationship between the client and service provider relies on specified qualifications and the awareness of accountability and regulations.<sup>18</sup>

### 5.3.1 Retail: a concrete example of the digitalization of services

Retail is perhaps the part of the economy that comes first to mind when we try to identify concrete examples of how digital innovations and technologies transform employment in a specific service sector. Recognized by high shares of female employees, retail is also by far the largest private service industry in the Nordic countries, measured in terms of employment (OECD.stat). As a labour-intensive industry that has traditionally been time- and space-bound and reliant on personal interactions with customers, the potential for the technological rationalization of retail work has traditionally been regarded as limited. Yet, in recent years, the increased use of digital technologies has led to faster productivity growth in retail compared with the rest of the Nordic economy (Steen et al., 2019). Digital technologies have enabled e-commerce and other new business models, as well as significant advances in logistics and distribution and the digitization and automation of in-store work tasks and equipment, including payments, self-service cash registers, digital order- and inventory systems, digital pricing and labels and digital customer data. Furthermore, the integration of online, mobile and physical shopping, as well as the increasing use of emerging technologies and new players in the retail industry, ranging from startups to tech giants such as Amazon and Alibaba, mean that we will likely see more changes in Nordic retail over the next 10 years than we have seen in past decades (EY, 2018).

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18. A more detailed description of methods and empirical materials used in the analysis of each sector can be found in Appendix 6.

## A changing technological landscape

Rapid technological development has changed how consumers buy goods, as well as how work tasks are organized in retail stores, warehouses and distribution. In contrast to the banking sector and elderly care – discussed below – there are comparatively few regulative barriers to the implementation of new technologies. By being a highly competitive and market-driven industry with small margins, new technologies tend to be widely adopted in retail if they are cost-effective and provide businesses with a competitive advantage. Investments and the rate of adoption naturally vary widely, from e-commerce startups and tech giants to traditional independent retailers with minimal margins, which tend to be later adopters and to rely mainly on mature technology. Nevertheless, a number of common trends and technological shifts that affect work in retail can be identified from the literature (see e.g. Hagberg et al., 2016; Pedersen et al., 2018; Steen et al., 2019).

Most obviously, digital technology has enabled an increasing part of retail to be conducted online: Nordic e-commerce had a revenue of 230.2 billion SEK (21.87 billion EUR) in 2018 (PostNord, 2018). The revenue is highest in Sweden, which also has the highest proportion of people shopping online. In the decade from 2008 to 2018, Nordic e-commerce revenue more than tripled, and is expected to continue its rapid growth (ibid.), a development that has accelerated as a result of the coronavirus pandemic, with a 27% increase in Q1 2020 alone.<sup>19</sup> E-commerce giant Amazon confirmed plans for an imminent launch in Sweden in August 2020, likely with ambitions of expanding to the rest of the Nordic countries. Altogether, this signals that retailers will be facing increased competition from e-commerce in the years to come. Traditional retail and e-commerce are also increasingly merging: As noted for some time in the research literature on the retail sector, new business models are spreading, and a main trend is channel integration (Verhoef et al., 2015; Scott et al., 2017; Pedersen et al., 2018). Multi- or omnichannel retail strategies thus aim to combine mobile, online and physical shopping to deliver a complete customer experience.

In addition to e-commerce and mobile shopping, which still represent a small part of both revenue and employment in the retail industry, digital technologies are also changing retail value chains and work tasks in physical stores. Previous research, based on interviews with managers in Norwegian retail (Steen et al., 2019), highlighted three technological trends the respondents saw as having had a transformational impact in physical stores over the past decade. *First*, more efficient logistics solutions – in stores primarily exemplified by semi-automated digital systems for orders and inventory – have reduced labour costs and improved the efficiency and accuracy of retail logistics. These systems automatically log sales and inventory, telling staff what goods may sell out, estimate the quantities needed and produce a suggested order list. Hand-held scanners also enable more efficient and continuous monitoring of the inventory. *Second*, digital and partly-automated pricing systems enable more dynamic and thus competitive pricing. These systems can be linked to electronic shelf labels that save valuable time previously used to replace labels by hand. *Third*, new payment systems, including computerized cash registers, contactless payment and self-service scanners, are changing the tasks performed by shop employees. The result is a reduced number of work hours needed for these tasks, e.g. in the check-out area of supermarkets.

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19. <https://www.dagensperspektiv.no/arbeidsliv/2020/enorm-okning-i-netthandelen>

Beyond the abovementioned technologies, advances in technologies, including artificial intelligence (AI), algorithms, sensors, data processing, storage and 5G networks, are also creating new technological opportunities. Contrary to previous claims that services are less apt to technological rationalization, retail is now considered to be especially susceptible to the transformative power of these new generic digital technologies (Carlin et al., 2015; Grewal et al., 2017). Robotized storage and logistics, AI-driven customer profiling and facial recognition, augmented reality, blockchain-powered tracking of goods, in-store 3D-printing and cashier-less stores with automated check-out using cameras and sensors are just some of the examples of the tech positioned to shape the future of retail. Retailers are thus currently experimenting with ways to respond to new shopper expectations, bridge digital and physical shopping experiences and try new ways to transform customer experiences, as well as to handle back-office processes and logistics.

Employment and skill requirements in retail

Despite this multiplicity of new technologies, retail employment in the Nordic countries has remained relatively stable over the past decade (see Figure 5.2). At the same time, productivity has increased, while work tasks appear to be slowly shifting away from routine manual tasks and increasingly towards customer interaction and personalized service (Steen et al., 2019), indicating that the variety of new digital technologies has already had a significant impact on employment developments.

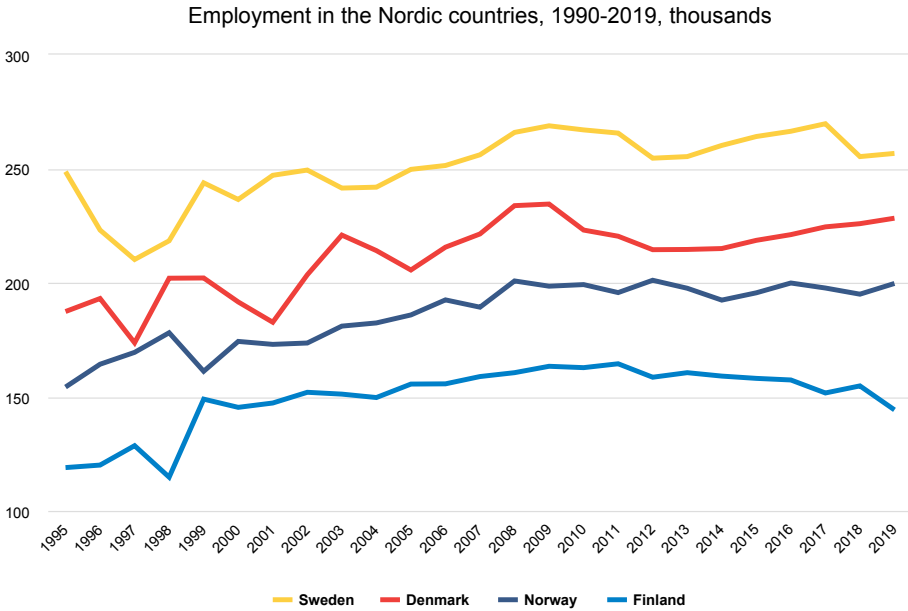


Figure 5.2 Total employment (persons) in retail trade, except for motor vehicles and motorcycles. Nordic countries. NACE 52 (Rev. 1.1 1995–2007); NACE 47 (Rev. 2, 2008–2019) (OECD. stat, Eurostat LFS)

Historically, the development of retail employment has closely mirrored household consumption and population developments. In parallel with digitalization, a gradual decoupling of this relationship seems to have occurred. Especially during the past decade, employment growth has showed signs of stagnation, while household consumption and population growth have not. From 2009 to 2019, as shown above, retail employment in the Scandinavian countries has seen virtually zero net growth in the number of employed persons, while Finland, which had slower overall employment growth in the period, saw a small net decline. Measured in the share of total employment, retail employment declined in all four countries in this period. This was likely due to increased retail productivity, following urbanization and technological advances (Samfunnsøkonomisk Analyse, 2017; Steen et al., 2019). An extrapolation of this trend based on Norwegian data from the past decade and official population projections shows that by 2040, total employment can be expected to shrink by 8% in retail and 9% in wholesale, whereas the population is projected to increase by 13% (ibid: 36).

In other words, we can expect retail employment, as we know it, to make up a shrinking proportion of the labour market. Further, the skills needed in retail are changing, partly due to technological rationalization. Compared with the rest of the economy, the labour market in retail has had low barriers to entry with low or no formal educational requirements, and thus a large share of low- and unskilled workers. Firm-specific training programmes and well-established internal career paths have meant that retail is not only an important first step into the labour market for many, but also one of relatively few industries where workers with little formal education can make a career. Consequently, retail has served an important function for the labour market inclusion of female re-entrants, young people, immigrants and other more or less marginalized groups, including those in various forms of supported employment schemes (Nergaard and Steen Jensen, 2017). The ongoing technological shifts and expected decline in the share of total employment is likely to challenge this role. Manual tasks in stores and logistics are increasingly automated, while retailer strategies and customer expectations are shifting towards more specialized customer service. Along with a growing need for data analysts and other technologists, especially in e-commerce,<sup>20</sup> the importance of interpersonal, language and service skills – essentially, skilled salespersons – is increasing (Steen et al., 2019). While these skills have always been valued, they are becoming increasingly essential as competitiveness hinges on providing differentiated, high-quality customer experiences (ibid).

In terms of job quality, the developments appear to be largely positive for in-store workers, with more varied workdays due to fewer routine and manual tasks. The pressure towards skills "upgrading" stemming from new digital tech is, however, largely viewed as minor, as most new systems implemented are user-friendly and off-the-shelf. Several managers interviewed described that the digital know-how employees needed comprised the ability to use a smartphone. They also expected that they could meet this competence need by training existing employees (Steen et al., 2019). A problematic trend is the increasing surveillance and control of employees enabled e.g. by in-store cameras and digital logs enabling detailed analyses of individual sales performance (Bråten, 2019).

The growth of e-commerce is likely to have differentiated consequences for job quality. In terms of employment, it is likely to spur demand for both highly-skilled

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20. A U.S. study conducted by Burning Glass showed that while 12% of advertised jobs in traditional retail were for candidates with university degrees, this share was 78% for jobs in e-commerce (Citi GPS, 2017).

workers in e.g. data analytics and automation, and lower-skilled workers in logistics and warehouses. While the former group enjoys relatively high wages and job quality, for the latter, the working conditions, pay and overall job quality tend to be lower. Nevertheless, new digital technologies and automation may also contribute to upgrading and increasing skill demands in logistics (see e.g. Steen et al., 2018). Amazon's Nordic market entry will likely lead to increased price competition and, if their U.S. track record on employees' rights and working environment is anything to go by, possibly also downward pressure on job quality.

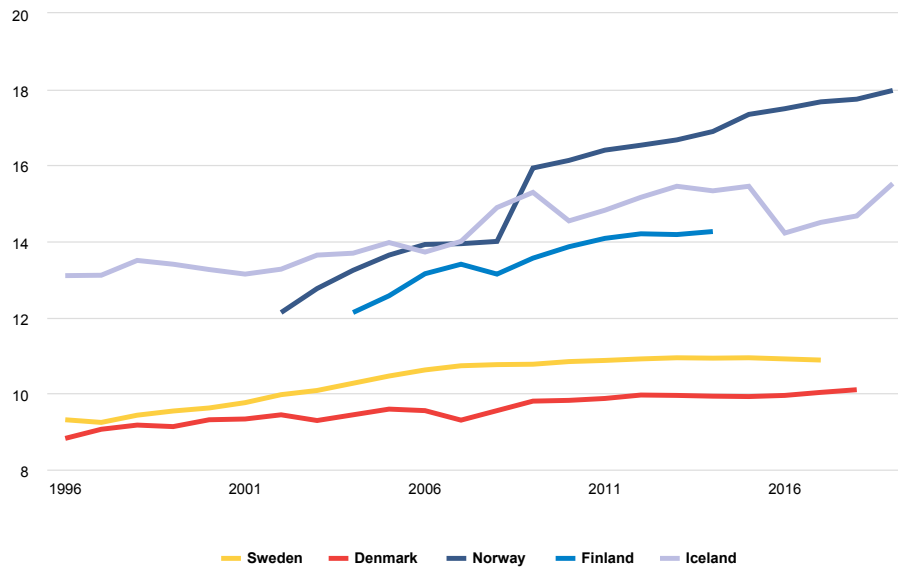
### 5.3.2 Digitalization and transformation of work in elderly care

Our second case of service work comprises a study of elderly care in Finland and Sweden, where women in both instances account for the majority of employees. Municipalities carry the main responsibility for elderly care in both these countries. Due to strained budgets and the increasing demand for elderly care, many municipalities in Finland and Sweden have, since the 1990s, tried out new forms of organizing elderly care to minimize costs (e.g. Stolt et al., 2011). For instance, more older people are now being offered home care rather than institutionalized care (Kröger et al., 2018; Strandell, 2020), and municipalities have outsourced a growing share of their elderly care services to private companies. In Finland, the proportion of elderly care employees that work in the service of private enterprises is over 20%, the share being smaller in home care than in institutional care (Kröger et al., 2018). In Sweden, figures from 2016 indicate somewhat lower numbers, with 15% of workers in elderly care being employed by private companies (Ekonomifakta, 2018). However, a substantial majority of elderly care work still takes place in public nursing homes.

Care-providing organizations face a continuous growth in demand driven by demographic change, as the number of Nordic inhabitants over the age of 85 years has increased and – according to statistical projections – will continue to increase heavily during the next couple of decades (OECD, 2020). For many municipalities, it is becoming increasingly difficult to strike a balance between the growing needs for municipal services and economic restraints in a context with an anticipated relative decrease in the working-age population contributing to the funding of the sector (SKL, 2019). Municipalities in both countries also struggle with difficulties in recruiting a sufficient number of competent personnel. The decreasing attractiveness of elderly care work seems to stem from high workloads, understaffing, reduced job autonomy and support, an accumulation of work-related problems and low pay and status (e.g. Stolt et al., 2011; Kröger et al., 2018). Hence, many elderly care workers feel that the time for social support and interaction with the elderly has diminished over time. Elderly care work has thus been the subject of much negative publicity in recent years, owing also to serious negligence by certain (mainly private) nursing homes in the care of their residents. During the coronavirus pandemic, these issues have been further highlighted in the media because of the apparent difficulties for many care-providing organizations in guaranteeing the safety of their patients and securing enough personnel to manage the crisis.

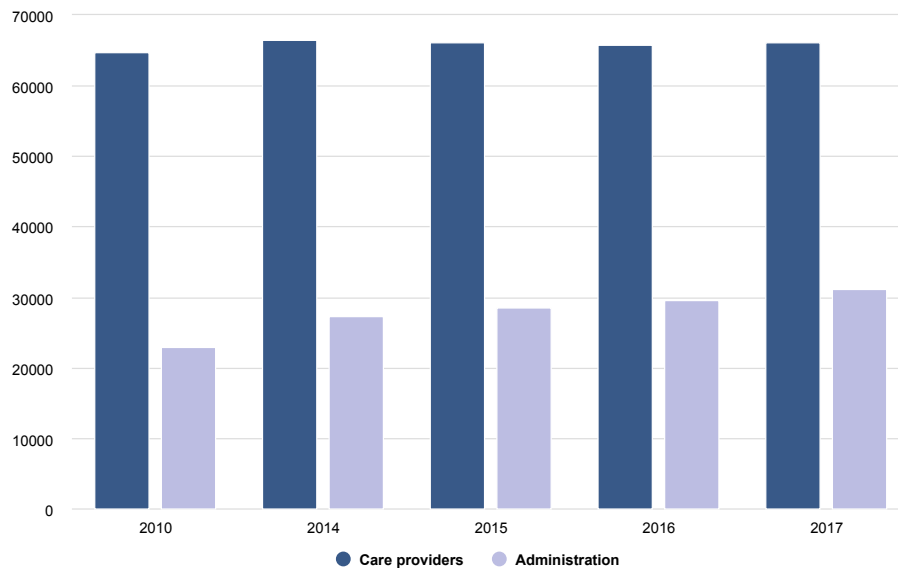
Being part of health and welfare services that are under increasing pressure, digitalization rather emerges as a means for the municipalities to improve their capacity to cope with the increasingly complex demands on existing services. It is regarded as a resource that may help elderly care tackle the demographic challenges and shortages in HR. Unlike in some other sectors, new digital technology in care

does not seem to involve a reduction in the number of jobs. Looking, for instance, at how the proportions of nurses have developed in the Nordic countries (Figure 5.3), we can see that the numbers are relatively stable or slightly increasing.



**Figure 5.3: Practicing nurses in the Nordic countries, per 1 000 inhabitants (OECD.stat.)**

Neither in Finland nor in Sweden is elderly care a sector where the introduction of digital technology is linked with shrinking job opportunities. Instead, it is said to help elderly care to meet some of the sector's growing future labour needs by freeing up the time of workers to focus on "core tasks", i.e. that of immediate care. Comparing various occupational groups, however, Figure 5.4 illustrates the development in the numbers of caregiving and administrative personnel in Sweden since 2010. It is noteworthy that the relative proportion of administration has increased, indicating that more administrators rather than care personnel compensate for the growth in care production.



**Figure 5.4: Numbers of care providers<sup>21</sup> vs. administrators<sup>22</sup> in Sweden, 2010–2017**

Against this background, digitalization emerges as a means for the municipalities to improve their capacity to cope with the increasingly complex demands on existing services. Digital technology is a resource that helps elderly care tackle demographic, administrative and economic challenges. Although digitalization has not involved a shrinkage of job opportunities, digital solutions have then also substituted the need for hiring additional personnel for performing care-related work. Consequently, digitalization may help care-providing organizations retain their budgets.

#### Various forms of digitalization in elderly care

The various technologies used in Finnish and Swedish elderly care range from individual devices designed to reduce physical strain at work or facilitate remote communication between care personnel as well as between caretakers and the elderly, to digital infrastructures used for planning and administrative work, such as electronic patient records, enterprise resource planning systems (ERPs) and route optimization systems. While some of these technologies are now well integrated in work practice, others are less frequently used. For example, in Finland, devices or systems such as desktop computers, smartphones, safety bracelets, electrified person lifts, email, and client or patient information systems are now deployed by more than 80% of employees, whereas, for example, the use rate of meal automatons, telecare equipment and social robots (e.g. Paro) is still less than 5% (Karhinen et al., 2019). There are also several examples of technologies that, for various reasons discussed in the end of this section, have been used for merely shorter periods.

With the help of new digital tools and information systems, care providers have sought to reduce operational costs and improve the co-ordination and flow of

21. Care providers categorized according to the occupational groups organized by the Swedish Association of Health Professionals (Vårdförbundet).

22. Administration does not include care-related administration (Vårdfokus, 2018).

information across operations. This can be understood in relation to the various forms of digitalization focusing on generating more effective systems for production, administration and communication. However, in the case of elderly care, it is apparent that digital technology is also used to enhance the autonomy, activity, well-being and safety of the elderly, thus aiming to improve the quality of care. In Table 5.1, we provide some examples of technology used in the Finnish and Swedish cases and illustrate how the integration of digital solutions responds to one or several of these different forms of digitalization.

Technology	Production	Administration	Communication	Quality
Medicine-dispensing robots	Save time and work effort of the care personnel by diminishing the need for short home visits	Monitor and register disposal of medicine dosages	Alert caretakers when the elderly has not picked out her/his dosage	Patient well-being and autonomy
Mobile documentation and e-signing	Reduce the time caretakers spend waiting to document their visits on the joint computer	Monitoring and control of work by management	Increased transparency around performed work tasks and current state of the patients	Availability of up-to-date information may increase quality of care
Digital locks	No need to keep track on set of keys	Monitors time and length of visits		
GPS alarms for geo-fencing				Patient autonomy (allow the elderly to move inside certain set borders before the alarm sets off)
Electronic patient records		Facilitate administration	Increased transparency (in some parts)	
Enterprise resource planning systems (ERPs)	Facilitate planning	Save time/ resources in administration		Improved reliability
Social robots (pets)				Patient well-being
Route optimization systems	Reduce time spent on home visits			
VR-glasses, motion-sensing devices for video games, surf pads and interactive displays				Patient activity
Apps and software			Facilitate communication caretaker - client	Patient well-being, autonomy and activity
Camera supervision in patients' homes	Reduce the number of visits			Patient safety and autonomy

**Table 5.1: Examples of technology used in the Finnish and Swedish elderly care cases and how it responds to various forms of digitalization**



For the municipalities that are striving to maintain a restrained budget, keep up the quality of care and still provide care to a growing number of elderly, it is essential to introduce technology that enhances cost-efficiency. In this respect, the digital technical solutions offer means of rationalizing work processes in ways that decrease the necessary number of work hours. As argued by Manyika (2017: 54), automation in the care sector has the potential to reduce waits and increase productivity. Through such measures, the growth of jobs within the sector is projected to be reduced by 7% (Fölster, 2015). Nevertheless, the interviewees emphasize that these initiatives are not aimed at cutting the number of staff, but are primarily meant to tackle difficulties in finding enough competence to cater to the increasing number of elderly people. They talk about freeing time-resources that the municipality can use for tasks where the competence is more called for. The difficulties the municipalities have in attracting sufficient staff also make it necessary for them to find ways to respond to current and increasing needs without having to hire new staff.

For instance, medicine-dispensing robots, which are installed in the senior citizens' homes, remind them when to take their medicine. These robots can also be programmed to remind them about other daily routines, such as taking bread out of the freezer. In cases when the elderly person does not pick out the medicine provided by the robot, the machine sends an alarm to the caretakers, who can follow up on the deviation. The use of these robots diminishes the need for short home visits, freeing up time for care personnel to spend on other tasks. In the case of a Swedish municipality, for instance, the use of 22 medicine-dispensing robots enabled a reduction in the number of hours spent on distributing medicine equivalent to four full-time employees in a year; this technology thus enables a rationalization of care work. However, it also provides a time-efficient solution for administration and communication about medicine disposals. Finally, the interviewees argue that the robots add to the quality of the care provided. By using the robots, too frequent or unwanted visits from the caretakers are avoided, the elderly get their medicine on time (which is often not the case with the caretakers' currently strained schedules) and the care visits can be used for other tasks, such as physical activity.

Elderly care work also involves tasks that aim to strengthen life quality for the residents and promote healthier residents with fewer care needs. A major problem in home care, and a barrier to improve the quality of care and "customer satisfaction" in this respect, is the great variation in the demand for services within a day. The use of digital solutions for such purposes are generally referred to as "welfare technologies" (Hofmann, 2013). In the Swedish case, the interviewees often talk of digital technologies in relation to such ambitions and work tasks. For instance, home care services could use surf pads to facilitate interaction with the elderly and enhance their involvement in activities such as online grocery shopping or Skype calls with family members. In special housing for patients with dementia, the use of GPS alarms<sup>23</sup> may be used as a solution to let the doors to the patients remain open. While this allows care-providing organizations to obey the law (which prohibits them to lock the doors), it is also presented as positive for the quality of welfare as it calms the residents. Moreover, digital tools may create opportunities to improve how caretakers schedule and spend their time with the elderly; if the client has had the opportunity to take her/his medicine in advance, she or he may, for instance, sense

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23. GPS stands for global positioning systems.

pain relief and be more capable when the caretakers arrive, allowing them to prioritize (more) strenuous activities. Although these solutions may have been introduced with the quality of care and well-being of the patients in mind, they likely also facilitate the provision of care since healthier and more autonomous elderly people are easier to care for and thus require fewer resources.

So far, however, the new (digital) technologies that have been taken into use in elderly care work have not fully met the expectations of freeing up more time for face-to-face interaction with the elderly. Less than half of the workers in a national Finnish survey feel that this has happened (Karhinen et al., 2019). On a positive note, it is a more common experience, according to the same survey, that the adoption of smart digital technologies in elderly care has made their work safer for customers (the survey does not describe in what sense).

Noteworthy, the integration of smart digital technologies in elderly care also varies by the context of work. Home care workers – whose work is much more mobile than that for those in nursing homes – are more active users of smartphones, emergency phone systems, medicine dispensers, meal automations and ERPs than are workers in institutional care or service housing. The work of home care employees is not only more diverse concerning the use of technological applications, but also more technology-dependent. About 60% of Finnish home care workers use digital solutions at least half of their working time, i.e. twice as much as the other groups (Karhinen et al., 2019).<sup>24</sup>

#### Implications for competence and skills requirements in elderly care

As a result of the increasing dependency on digital solutions in the work of home care employees, an increasing part of their work now includes different kinds of registrations and other administrative duties. As the number of drug distribution visits decreases, for instance, the work of home care employees is shifting towards more remote monitoring, virtual interaction, service guidance and working on computers.

Related digital competences are thus essential among home care workers. Yet, there seems to be great variation in the workers' ability to use, for example, smartphones. In Finland, it is estimated that half of the workers in elderly care feel that there are shortcomings in the support they have received for using information technology, information systems or digital devices and applications (Karhinen et al., 2019).

The new technology also requires competence for maintenance and problem-solving related to the technology. In the Swedish case, the organization of an interviewee had developers engaged with e-health and a group of coaches who work with peer education, aiming to bridge the gap between this group and the rest of the personnel, and who participated in developing the use of different technologies.

A certain set of skills and competence that were stressed in the interviews pertained to integrity issues, ethics and legal/regulative or normative demands, generating new and challenging administrative tasks. For instance, various surveillance technologies (e.g. cameras, GPS, door sensors) raise legal and ethical questions about how care workers should respect and manage the integrity of the elderly. It

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24. In the survey, the workers were divided into five different groups. The other groups were "enhanced-service housing", "institutional care", "service housing" and "other".

was claimed that managing the families and their consent to the use of such technology is one of the most challenging work tasks. The Swedish interviewees, for example, stated that they managed the privacy aspects of geo-fencing by only allowing a few people in the staff to follow the patients' movements.

It seems that several of the "new" competences required are provided for by a division of labour where the new tasks are assigned to few of the employees or to a certain group within the organization. In some instances, the competences may also be found outside of the organization. As for the case of the medicine-dispensing robots used in the Swedish municipality, the Finnish company that had produced the robot also provided technical support. Using a camera installed inside the robot, support could here be given from a distance.

### Trends in job quality

Our interviewees and prior studies (e.g. Socialstyrelsen, 2018; Västerås stad, 2018) suggest that the use of digital technology could potentially decrease the work burden and stress levels among elderly care staff. Yet, neither the Finnish nor the Swedish cases provided any examples showing that such hopes had actually been fulfilled. The interviewees in the Swedish case instead referred to *new physical health issues* such as neck and hand pain from using surf pads and mobile phones. Moreover, practical concerns for maintaining and developing their use of technology were also mentioned as sources to new and emergent work tasks that caretakers must integrate into their daily work. In Finland, as many as three-quarters of the care workers associate the increasing technology-intensity of work with an increased workload (Karhinen et al., 2019).

When introducing new technology in an organization, it is common that employees worry that work tasks will be changed or redistributed in ways that alter the status or workload between different occupational groups (e.g. Sung et al., 2017). The integration of new technology into work practices has also been shown to alter perceptions of status and gender of certain work tasks (e.g. Sörensdotter, 2008; Abrahamsson and Johansson, 2020). In the Swedish municipality, the interviewees provided an example of how such changes could foster issues when they described how the nurses were initially assigned the responsibility of refilling the new medicine-dispensing robots. As the distribution of medicine had previously been delegated to assistant nurses and care assistants, this responsibility meant that the nurses were ascribed an additional work task to an already strained work situation. Eventually, however, the previous order was reinstated by letting care assistants – educated in how to manage the robots – perform this task as well. Most importantly, however, work was reallocated from care workers to the elderly, who could medicate, monitor and document themselves by engaging in various forms of self-care supported by digital means (SOU, 2016).

Although new tasks were assigned to some of the employees, the Swedish employer did not link competence development involving the use of new digital technology with raised salaries or rewards; not even those who became "technology coaches" received additional salary. According to the interviewees, however, references to this type of competence could influence the individual wage-setting and thereby involve a higher salary. We have no data with regard to whether this was actually the case.

## Employment and labour relations issues in elderly care

In Sweden, the coverage of collective agreements and union density within the care sector is high. In 2015, 100% of public employers and over 90% of private employers had signed collective agreements for their blue-collar workers (Kjellberg, 2017). Among the employees working within health and care in 2018, 72% were members of a union (LO, 2018). In Finland, 92% of employees in health care and welfare were covered by binding collective agreements in 2017–2018 (Ahtiainen, 2019b). It can be estimated that about three-fourths of employees in public and about half in private health care and welfare services are unionized (Ahtiainen, 2019a).

In both Finland and Sweden, it is argued that the growing use of digital technology may reduce the need for man-hours in relation to certain work tasks, but, given the increased need for care, doing so will only slow down job growth and usually not lead to dismissals. However, the interviewed trade union officials in both countries raised many critical viewpoints concerning the introduction of smart technologies in elderly care. In particular, they expressed concern for shortcomings in the municipalities' purchasing expertise and change management competence as well as in their policies of introduction and skills updating. The latter concern is partly related to the scant personnel resources and consequent lack of time during normal working hours to be spent on in-house training or education.

Being critical towards the one-sided monetary indicators that are applied by municipalities in justifying technology purchases and measuring their success, the union officials were also concerned about the lack of long-term strategic thinking in municipal elderly care. This is well illustrated by the fact that among the numerous pilot experiments with new technological applications conducted in both countries in recent years, quite few cases have led to established use, let alone wider dissemination.

## Lessons and perspectives for the future of elderly care

In elderly care, various forms of digital technology are used to facilitate the provision of high-quality care in organizations that simultaneously struggle with sharp budget restraints and a lack of both sufficient and qualified personnel. By freeing time from now digitalized work tasks, these hours could be spent for work tasks that would have otherwise required a second worker. Hence, digitalization could be said to both free up time for "core" care work and save money for the care-providing organizations. This may seem like a win–win situation; however, the case studies also highlight a number of aspects and difficulties that need to be further researched, discussed and taken into consideration by digitalizing organizations.

First, the introduction of new technologies in care is seldom a straightforward process and there are often problems with the usability of new systems. Successful implementation often requires a lot of customization when introduced and a lot of "tinkering" and "domestication" when utilized and further developed in everyday use. The introduction of digital solutions thus entails a significant threshold as learning and tinkering with the technology initially tend to slow the work process and add to cognitive stress and workload.

Moreover, acquiring digital technology represents substantial investment for the municipalities, raising various problems related to the purchasing process. The trade

union officials in Sweden argued that the municipalities' purchasing expertise is sometimes insufficient as it requires specific knowledge of the technology itself. Purchasing problems are also caused by public procurement rules, sometimes making it hard to stick to the same distributor and forcing the municipalities to substitute a functioning technology for another. Hence, in some cases, purchased technologies were not being used and ended up in storage somewhere. The reason for this could be that only special individuals who had already left the workplace were able to use it.

Another challenge concerns integrity and privacy issues. In the case of the "second generation" medical dispensers, that, in addition to drug dispensing, can be used as a versatile communication tool between clients and home care, other health services, family members or close relatives, the main constraint faced so far relates to data security and ownership. The robot produces a lot of different types of data, some of which can be very sensitive. The increased patient safety potentially attained by digital technology for monitoring and controlling the health and everyday life of the elderly or the employee's work activities must thus be weighed against the increased risk of privacy intrusion (Pols, 2012; Papadopoulos et al., 2018; Niemelä et al., 2019). It is not obvious in all instances what kinds of data will be stored, who can have access to the different types of data that are transmitted by the device, or to which information systems such data are lawful/allowed to integrate. According to the interviewees, these kinds of ambiguities can slow down the deployment of some applications enabled by the device itself.

Furthermore, the importance of fostering confidence in the new technology also involves patients' families. In Sweden, for instance, the municipality needs the families' approval for camera supervision. The interviewees stress that "all municipalities have them (surveillance cameras), but none has succeeded in using them". One main reason cited is a verdict from Gothenburg District Court judging that the use of camera supervision has to be approved by the patient. This verdict also touches upon broader integrity issues, further complicated by the fact that digital technologies are programmable and often come with a lot more functions than needed or used in daily work. Purchasers, like the municipality, thus have to check all details before entering an order. The Swedish interviewees illustrated this caveat by referring to how they accidentally purchased a passive alarm (stå-larm) with a built-in camera, which is not allowed in Sweden.

The acceptance among both care workers and patients for the use of technology in elderly care relates to what is often considered as the quality and ethics of care, i.e. care based on responsiveness, humanity and attentiveness. If the administration and monitoring that follow with managing the digital technology takes time from the "actual" care work, this can reduce the perceived meaningfulness of the job. It is estimated that robotics could now already replace about one-sixth of direct care work and 30% of indirect care work in Finland, i.e. in total, about 20% of all work done by care workers today (Kangasniemi and Andersson, 2016). Owing to the demographically-driven growth of demand for care services, this would not, as such, undermine employment prospects in care work. Care workers' scepticism towards, for instance, robots, does not mainly stem from a worry of job displacement effects, but rather, from a fear that robots will be increasingly used as a replacement for human touch and care workers' direct social interaction with the elderly (e.g. Rantanen et al., 2018; Socialstyrelsen, 2018). Here, we can also anticipate some

changes in how the occupations – altered by the increased use of technology – are associated with stereotypical notions on male and female jobs. Decisions and discussions regarding the digitalization of care thus ought to be sensitive to wider discussions about what constitutes “authentic” care (e.g. Nickelsen, 2013; Frennert, 2018).

Finally, digital technology raises new issues concerning the division of responsibility – between caretakers and patients – for the robots’ functionality and costs. The expectancy for the elderly to be able to manage the technology may also involve a redistribution of the responsibility of care, from the care organization to elderly individuals. According to a Swedish public report discussing the potentialities of digitalized care (SOU, 2016), the patient should be considered as “part of the team” and as a “co-provider” of her or his own care. Some of the digital solutions introduced in the care sector thus involve a seeming rationalization of work processes, which, in fact, may rather imply a reallocation of work tasks from paid to unpaid work.

### **5.3.3 Digitalization and transformation of work in the Nordic banking sector**

Our third case draws on interviews with representatives of management, shop stewards and social partners in Danish, Finnish, Norwegian and Swedish banking. Already during the 1980s and 1990s, the Nordic banking sector was reshaped by sweeping restructuring involving digital technology and employment decline associated with the banking crises, deregulation and the adoption of automated teller machines. During the first decade of the 2000s, developments in the Nordic banking sector were affected by further liberalization of the financial markets, implementation of monetary unions and the launch of a single currency (the euro), along with further advances in ICT. The global financial and economic crisis of 2008–2010 ended a period of strong growth in the sector. In the aftermath of the crises, the European Union (EU) took action to provide more adequate regulation of the sector, with the aim to enhance financial stability, market efficiency, trade transparency with financial instruments and customer protection. As a result, banking is now one of the most regulated sectors in Europe. Stricter regulation has led to higher administrative costs and staff being replaced by personnel with skills in risk management and compliance. Complexities related to digital transformation, cyber security and uncertainty linked to Brexit brought new challenges for the sector in the mid-2010s, amplified by the risk of trade and tariff wars, climate change, geopolitical tension and the emergence of the so-called fintech companies.

Our interviews suggest that the dynamics of change in the banking sector during the digital transformation do not differ greatly from country to country, reflecting how in particular, the leading Nordics banks establish themselves across Nordic national boundaries. As a result, this section looks at the Nordic countries as a whole, with the opportunities and threats faced by each country appearing to be largely similar.

#### **Changing business and technological landscape in banking**

Digital transformation has become an integral part of the strategy by which banks have sought to adapt to the changes in the business environment. We may distinguish at least three forms of transformation in the sector. *Firstly*, as a highly

data-driven business, the financial sector has led the way in automation of many services and supporting tasks and operations. A great deal of the data in the sector are structured and stored in digital databases. Many of the jobs include simple computational tasks and the analysis of such data that lend themselves easily to automation (Frey and Osborne, 2017; PwC, 2018).

*Secondly*, the advance of digital technology helps banks develop new services provided via web-based communication. These services include online and mobile banking, chatbots, videoconferencing and various kinds of apps. The banks' service networks can consist of many different channels. A traditional bank branch, engaged with conventional office services, can be combined with online and mobile banking and social media, forming a multi- or omni-channel service network. However, net-based digitalization of services requires large investments in ICT and digital infrastructure. Yet, investments in banking slowed in the 2010s as a consequence of the financial difficulties faced by many banks owing to slow economic growth, a turbulent business environment, low and negative interest rates and rising regulation costs. There are now significant differences in the level of digitalization of banking services in European countries, stemming from differences in the banks' financial capacity to make the necessary investments as well as in the overall technological infrastructure of the countries, such as the prevalence of mobile broadband subscriptions and people's familiarity with online transactions. Another challenge regarding ICT investments is company size. Whereas large banks typically have their own ICT departments, smaller ones depend on external support. One possible solution available for smaller players has been the pooling of resources, as shown by the following Danish example.

### **Box 1: Bankdata**

Bankdata is a large financial ICT development house in Denmark with 750 employees. It was founded in 1966 and is owned by nine Danish banks, which are also customers of the company. Bankdata provides complete ICT solutions, including the development of network and mobile banking, credit and advisory tools, support and security, for all nine banks. This is especially an advantage for the smaller banks, which cannot afford to do this on their own. The banks actively participate in the planning and development of Bankdata's activities. In recent years, the focus of the company has been on creating agile organization processes, where new ICT solutions are created in close co-operation with single banks and user-experience staff. This has been a strategy to solve the dilemma between sharing ICT solutions and meeting individual demands among the customer banks. The customer banks especially request new digital self-service solutions, whereas AI and machine learning-based solutions are still limited. Another focus has been to handle new demands in relation to compliance. This has led to new competence requirements. Although ICT specialists still make up most of the staff, a larger share of the employees now have a university background within law, economics, business or the social sciences.

*Thirdly*, digitalization has transformed the sector by easing the entry of new, highly specialized competitors into the market. This has led to the emergence of what research sometimes describes as “ecologies” of financial competitors, competing and sharing data with each other (Cai, 2018). The ecologies comprise not just banks, but also a set of interdependent financial actors, ranging from pure online banks to so-called fintechs, i.e. non-banking institutions that carry out selected banking activities. Fintechs, varying from big global corporations to small start-up firms, play a key role in these ecologies (Dapp, 2014). Fintechs have so far had the best opportunities in relatively simple standardisable services, especially in the provision of new payment systems, building their competitive strength on the ability to gather detailed data on customers via the Internet, which allows them to address customers more directly and individually with their products and services compared with traditional banks. The market position of fintechs is also strengthened by the Payment Services Directive (PSD2) that took effect in 2018, obliging banks to open access to customer accounts for other service providers, if the customers so agree.<sup>25</sup> On the other hand, the hurdles for newcomers are high in more complex financial services owing to the regulated nature of the sector as well as the need for building a strong trust relationship between the customer and the provider and the larger ecosystem that the provision of these services often requires. Still, to this day, the role of fintechs in the Nordic market is minor, but they may gain a further foothold in the market by operating in alliance with traditional banks. In so doing, we also find Nordic success stories that aim to scale up their business at the international level.

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25. The Revised Payment Services Directive (PSD2) was introduced to regulate payment services and service providers throughout the [European Union \(EU\)](#) and [European Economic Area \(EEA\)](#). For further discussion, see, e.g. [Wolters and Jacobs \(2019\)](#).



## Box 2: Copenhagen Fintech Lab and Nord Investments

Copenhagen Fintech Lab is a co-working space housed by The Financial Services Union Denmark (Finansforbundet). It was created by the social partners in Danish finance and industry and supported by a wide range of partners, including Danish and other Nordic banks and global players in finance. The lab's aim is to "develop Copenhagen as one of the leading Fintech Hubs in the global financial services industry by supporting and catalyzing the next era of technology-led corporate and startup innovators". Copenhagen Fintech Lab has attracted a lot of attention, and international delegations often visit to get an overview of important trends in the fintech landscape. Finansforbundet and the other lab partners have co-funded the lab and used it to get familiar with the new fintech players and survey new competence needs in finance. Today, the lab houses 50 fintech startup companies, but more than 120 in total have been through the lab, and several of these have left as larger, successful finance companies.

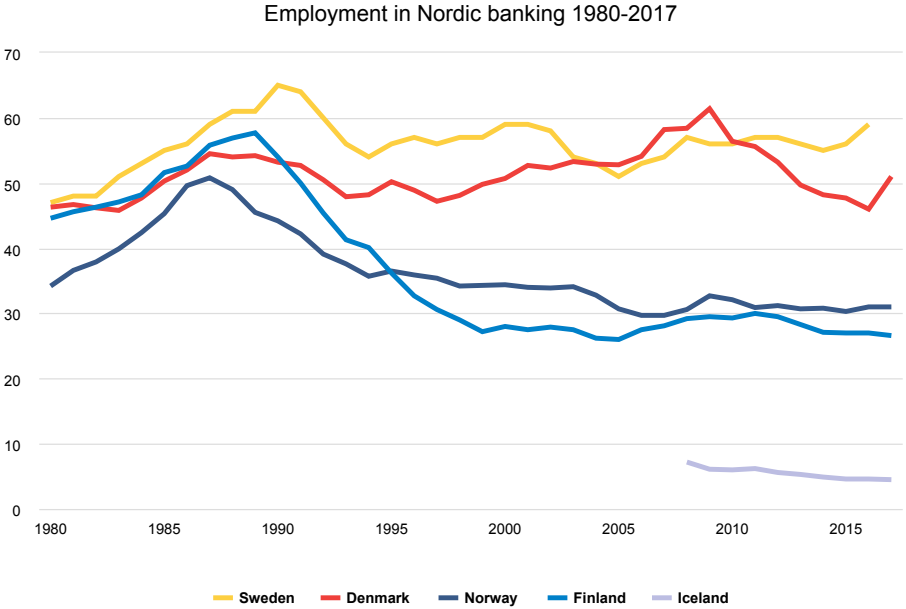
One of the successful fintech companies that started in Copenhagen Fintech Lab that has now consolidated itself outside the lab is [NORD.investments](#). [NORD.investments](#) is a digital investment advisor that offers a completely digital investment experience. It was founded in 2016 and grew quite quickly. Today, the company has nine employees and 1500 customers and is situated in central Copenhagen. The company co-operates with a larger Danish tech bank, Saxo Bank, which works as their infrastructure. Nord.investments wants to expand into other countries inside and outside the Nordic countries, but here, they depend strongly on a partner bank, which might define their choice of countries. Furthermore, they need both legal support and support in relation to compliance, where national variations can be a barrier.

According to many of our interviewees, the entrance of the Big Tech corporations, such as Amazon, Apple, Facebook and Google, may constitute a more serious challenge for conventional banks than the rising number of smaller fintech companies. As a response, some Nordic banks have already developed app-based payment solutions that appeal to this market, such as Mobile Pay introduced by Danske Bank in 2013. Mobile Pay has been adopted by many other Nordic banks and companies. It is market leader in app-based payment solutions in Denmark today, while VIPPS, owned by a coalition of national banks, dominates the Norwegian market. Swish, introduced by a similar coalition of banks, dominates the Swedish market.

### Changes in the structure of the sector and jobs: "from tellers to sellers"

In spite of the increased internationalization of the financial sector – not least within the EU single market, as vividly demonstrated by Icelandic finance companies in the early 2000s – the Nordic banking market constitutes an increasingly integrated but still relatively protected segment of the wider European market. Many of the largest banks in the Nordic countries operate across the Nordic boundaries and have a more

or less distinct Nordic profile. The structural changes in the banking landscape have signified a clear decline in the number of companies and branches in the Nordic banking sector, while reductions in employee numbers have been less dramatic in recent years. Figure 5.5 traces developments in employment in the banking sector and shows relative stability in the 2000s, except for marked declines in Denmark and Iceland after the 2008 financial crises, albeit not as dramatic as the boom and bust in the 1980s and 1990s in Finland, in particular. In Sweden, there has even been clear growth in recent years.



**Figure 5.5: Change in employment in Nordic banking, 1980–2017. In thousands (OECD.stat.)**

The drop in the number of companies and branches has been mostly due to mergers, boosted by tighter regulation, which has increased the operational costs of all banks and strengthened the position of the largest and most solid players in the market. The decline in the number of employees, in addition to mergers, owes to the increased use of digital channels resulting in the downsizing or closing of many branches, to automation and to the rationalization of activities in the pressure for increased returns on the part of institutional bank owners.

The number of branches is expected to further diminish as customers increasingly migrate to digital channels and banks rethink their distribution. There are analogies between banking and other data-driven industries, such as music and film distribution and print publishing, in which distribution channels have already undergone a major transformation. Being established in digitally advanced countries and aided by their relatively stable financial situation, the Nordic banking industry has been leading the way, even globally, in the digitalization of the sector (Grym et al., 2018).

However, the effects of digital transformation on the overall evolution of employment in the sector can be manifold. In some cases, digitalization has led to the automation of jobs and the substitution of human input for robots or some other technological devices, whereas in other cases, it has helped banks to achieve economies of scale and expand their businesses to new markets or countries, increasing their net sales and creating space for staff increases. Still, an advanced digital infrastructure can be a double-edged sword for conventional banks. On the one hand, it helps banks build competitive edges on new digitally-enabled opportunities for business development, but on the other, it lowers the threshold for new competitors to enter special segments of the market. Our interviewees also describe how this digital infrastructure facilitates services dependent on data-sharing across organizational boundaries, increasingly demanding that they engage in managing complex frameworks of regulations and building trust in the relationship to the customer.

The decline in the workforce has thus far mainly been concentrated in traditional "core" banking occupations. In the future, employees in back offices, branches, call centres and corporate headquarters will probably also be hit by advancing digitalization, whereas people working in technology development, compliance and (especially business) client-facing roles, such as sales, client advising and consulting, are in a better position. Though customer self-service and robotization are making rapid headway, there will also in the future be a large need for customized face-to-face or virtually mediated human-to-human interaction (e.g. Kelly, 2019).

#### Implications for skills requirements in banking

Our interviews support the view that digitalization is setting higher skills requirements for the staff in the sector. This view is also supported by a comparison of surveys conducted among HR managers in Finland, Denmark and Norway, which shows that there exists quite a unanimous view on the most important future skills in the sector; these include adaptability, professional self-improvement, digital skills, customer experience skills, self-direction and social skills, including teamwork and collaboration (Finance Finland et al., 2019). The data from the surveys also show that HR managers consider digital business and service development (e.g. mobile dialogue and payments, apps, chat, self-service) as the most important area in which digitalization is setting new requirements for companies in the sector. This is followed by automation, referring to the development and implementation of software robots and digital processes that happen by themselves, as well as data analysis and AI. However, more radical potential game-changers, such as the Internet of things or blockchains, were still at this point, only rarely regarded as important trends in the short-term future.

Changing skills requirements also appear to have led to a new recruitment pattern in the sector. For example, in Finland, where the most common educational background is still vocational qualification in business and administration, a university degree has become the most prevalent educational background among new people recruited in the sector. A clear trend during the 2000s in banking in the Nordic countries has been a rising proportion of lawyers and people with a master's or bachelor's degree of business administration at the expense of people with a lower level of education – often women. As mentioned, our interviewees also describe how complex arrangements of data-sharing between financial services (in many cases in different jurisdictions) foster new demands for legal awareness and skills in compliance.

Besides the rising level of education, another trend in recruitment is the diversification of the educational backgrounds of employees. A typical person working in the financial sector has traditionally had a degree or qualification in business, but in the future, there will be a growing need for recruiting data analysts, ICT systems developers and programmers, legal experts, compliance and internal control employees, business/customer advisors and business and product developers.

### Trends in job quality in banks

The financial sector as a whole fares well in comparisons of job quality. Financial services in Europe are leading all other major economic sectors in skills and discretion, physical environment, employees' future prospects, working time quality, level of earnings and incidence of ICT-permitted teleworking (Eurofound, 2016). The sector is characterized by a higher percentage of "high-flying jobs", as called by the Eurofound report, than any other major sector and, respectively, a very small proportion of "poor quality jobs". The major downside as compared with many other sectors is a high level of work intensity, which manifests itself particularly in time pressure, frequent changes in technology and regulations, problems with dissatisfied clients and the need to conceal emotions while working.

Time-series analyses show clear patterns of change in the content of financial sector work between 1995 and 2015 (Bisello et al., 2019). The most distinctive changes concern the increased use of computers and the Internet, alongside growing standardization. Standardization manifests itself as precise quality standards and numerical performance targets that employees face in their work, generating more repetitive tasks. Another clear pattern in the sector has been reduced direct social interaction with customers and colleagues. This change in the content of work is probably closely related to digitalization. The survey data also show that, despite growing standardization, tasks in the financial sector now include a greater amount of autonomy and problem-solving. From the job quality point of view, the observed changes in work are thus quite contradictory.

Our interviews largely confirm the overall view given above. Growing requirements for self-management in many of the jobs in banking manifest themselves as needs for the continuous updating of skills, organizing ones' own work in efficient ways and taking more responsibility for ones' own well-being. This requires the skilful deployment of new technologies, enabling teleworking and flexibility in the allocation of working hours, both of which are becoming a more common practice in the sector. Particularly in many customer-facing jobs, the employees act almost like entrepreneurs in practice, albeit driven by employer-set performance goals and rewards.

An additional factor that is putting pressure on the work of bank employees is the stricter regulation in the form of various EU directives. The Nordic Financial Unions (NFU) (2018) conducted a survey in 2017 on shop stewards in the sector in four Nordic countries (excluding Iceland) with the aim of studying the effects of new EU regulations on employees' work. The NFU report argues that the regulatory framework is opaque and complex, and that often, only a few professionals and experts understand it thoroughly. Ever more often, bank employees experience conflicts of interest between good customer service and requirements stemming from the new rules and procedures that regulate different niches in the sector.

According to shop stewards, the documentation requirements have increased substantially during the past 2 years. The same applies to know-your-customer requirements, and to some degree, the amount of information given to customers. All three of these aspects now take a large share of employees' working hours, leading to increased workloads and stress levels.

### Employment and labour relations issues in banking

Nordic banking employees are largely unionized. National unionization rates range from just under 50% in Sweden to nearly 80% in Denmark (Eurofound, 2019). The unions in Nordic banking – with the exception of Denmark – belong to central organizations that represent lower- and upper-level white-collar employees outside the LO/SAK axis (representing blue collar workers) – the traditional stronghold of the Nordic trade union movement.

Employment and labour relations in the sector have traditionally been consensual, and joint developmental activities launched by the parties have often been mixed with traditional bargaining issues. For example, in Finland, employers and unions have conducted many joint development projects in recent years with an eye to forming a shared outlook on challenges facing the sector and finding ways to meet the changing skills needs and promote employee well-being. This co-operation was consolidated in 2014 under the title of the "Healthy Financial Industry" project, involving the financial employers' association and four trade unions of the sector; this collaborative spirit still prevails as a looser development framework. Likewise, in other countries, social partners have co-operated in various formal and informal arrangements, focusing on issues such as automation, competence requirements, health and safety and fintechs (see Box 2).

Given the fast pace of change, issues related to skills development and training have been at the forefront of the bargaining agenda because of both digitalization and the new EU directives that set new formal demands for employees to meet the regulatory requirements. There is broad agreement among the bargaining parties in the Nordic countries regarding the need for the continuous updating of staff competences. However, the parties have had somewhat different views concerning the way in which such requirements should be met. Trade unions have assumed that this should mainly take place during normal working hours and through formal training, while the employer side has been more reserved towards formal clauses on this issue and emphasized the importance of learning at work, self-study and peer learning.

Another major bargaining issue has been weekend work. For example, in Finland, employers managed to get through a renewal in the bargaining round of 2018, which made it easier for banks in Finland to allocate work also for weekends. Trade unions in Finland have taken a cautious attitude to weekend work and argued that in practice, there is not much pressure towards more flexible working hours on the part of the customers. Also in Denmark, in the 2020 bargaining round, employers obtained a more flexible scheduling for working time and overtime, permitting more scope for individual planning. Yet, on the whole, weekend work is still quite rare in the banks in all Nordic countries.

A third major bargaining issue between employers and unions has been downsizing and structural adjustment of the staff, driven by mergers, pruning of the service network and the desire to release (often older) staff with obsolete skills. In line with

the consensual nature of employment and labour relations in the sector and due to the need to protect the banks' reputation in the eyes of their customers, cuts in the workforce have most often taken place through different types of financial support packages to outgoing staff than through direct redundancies.

### Lessons and perspectives for the future of banking work

The banking sector is at the forefront of the digital transformation of business and work. Digitalization in the sector manifests itself in various forms, such as the increasing automation of tasks and operations, the development of multi-channel service networks and the lowering of the market entry threshold for potential disruptors (e.g. Big Tech corporations and other fintechs). Digital transformation, together with stricter regulation of the sector, has in the Nordic banking sector led to a dramatic decline in the number of branches, while reductions in employee numbers have been more modest. Nordic banks as a whole have fared relatively well in the turbulent environment of recent years compared with banks in many other European countries. This has been partly because of the stable, high-trust Nordic institutional environment, including elaborate common payment systems and consensual labour relations, and partly because of the high rate of technological development of Nordic banks.

At the same time, the sector's occupational profile has changed radically. Bank employees have changed "from tellers to sellers"; that is, customer interaction has moved away from "more passive" processing of transactions towards more active looking for sales opportunities (Regini et al., 1999). In addition, an increasing share of new staff recruited in the sector has a university degree and ICT or legal compliance skills.

Coping with the high pace of change requires continuous upgrading of bank employees' skills. Both employers and trade unions agree that skills updating and training of the staff are of crucial importance for maintaining the competitiveness of Nordic banks, but the parties have partly divergent views on how this should be realized in practice. Bank employees are now increasingly required to take responsibility for organizing and self-directing their own work. The management and control of work is ever more often mediated through employer-set performance objectives and rewards.

While digitalization has implied increased the autonomy and self-direction of bank employees' work, stricter regulations arising from EU directives and the accompanying national legislation, on the other hand, has added a new element of control to work; this is most clearly apparent in the form of growing requirements for documentation. Stricter regulation and coping with compliance take up an increasing amount of the working time of people working in sales and advice, leading to occasional feelings of higher workloads and stress levels and conflicts of interest between good customer service and customer protection.

## 5.4 Summary – Services and the diverse consequences of digitalization

In the beginning of this chapter, we pointed out that the services sectors today constitute four-fifths of the total Nordic labour market, and that employment in services has continued to rise in the twenty-first century. Consequently, due to advances in digital technology, the question of whether we are entering into an era with declining demand for labour is largely related to what happens in the services sectors, where the potential for technological rationalization and automation has traditionally been limited. In recent years, however, a growing range of services industries has also proven susceptible to digital rationalization. This chapter has pointed out how, for instance, increased digitalized self-service provision in sectors such as retail and banking have made certain jobs, often female-dominated ones, redundant. As digital means today can mediate a growing spectre of service tasks, more and more service work is no longer dependent on the time- and space-bound relationships between provider and client. The unprecedented rapid adoption of digital communications and means for service delivery during the coronavirus pandemic has forcefully demonstrated the immediate potential for digitalization in a variety of services (Dieppe et al., 2020).

The analyses in this chapter have underscored that the impact, in terms of jobs, skill demand, business structure and other parameters, differs significantly from service to service. Given the diversity of services, we cannot expect new technologies to have a uniform impact. Many large labour-intensive services industries – typically care, education and health work – are still reliant on direct interaction with customers/clients and less susceptible to digital transformation despite digital technology being adopted to rationalize certain processes and enhance worker productivity. The size of the employment effects therefore depends on a range of economic, institutional and behavioural factors that also influence whether the gains in terms of productivity and value added exceed the costs of investing in new digital technologies, as well as the extent to which such gains are reallocated into activities that generate new jobs. The marked differences in service employment growth between the Nordic countries over the past decade are in this respect apparently more influenced by national differences in economic growth than by the pace of service digitalization.

The chapter has illustrated the variegated effects of digitalization by looking into three different parts of the service sector: retail, elderly care and banking. Constituting the biggest service industry in terms of employment – especially among women – *retail* is also a major employer of marginal or unskilled groups. Despite expanding customer demand and revenues, employment has flattened in recent years and is expected to turn downwards in the coming decades. At the same time, work tasks appear to be slowly shifting away from routine manual tasks towards customer interaction and personalized service (Steen et al., 2019). Digital technologies, not least associated with the expanding e-commerce environment, evidently play a crucial role in this transformation. Stagnant employment and rising productivity are also influenced by urbanization (Samfunnsøkonomisk Analyse, 2017). Estimations hence indicate that, e.g. total employment in Norway by 2040 will have shrunk by 8% in retail and by 9% in wholesale, while the population will have increased by 13% (Steen et al., 2019: 36). Similar trends are expected in the other Nordic countries, while international forecasts suggest even more radical job

decline. Taking also the ongoing shift in skill demands into account, such perspectives raise doubts about whether the retail sector can maintain its important function as an engine for the labour market inclusion of jobseekers with little formal education, female re-entrants, young people, immigrants and other marginalized groups (Nergaard and Steen Jensen, 2017).

In our second service, *elderly care*, the demands for a human presence in catering to the needs of ailing people, specific qualifications and awareness of accountability and regulations render it less obvious that new technologies will make work tasks much easier or faster. Struggling with high workloads, low pay and status and difficulties attracting a sufficient number of competent staff (SKL, 2019), none of our informants in elderly care linked digital technologies with shrinking employment. Digitalization emerges for them as a helpful means to tackle the increased demand for care caused by population ageing in the context of labour/skill shortages and budgetary restraints. Hence, the focus groups refer to gains in achieving more time-efficient administration of medicine disposals, leaving greater scope for interactions with patients, easier communication between patients and family members and improved safety for dementia patients by using GPS. The interviewees nevertheless express concerns for how to tackle the great variation in demands for service. The claims that new digital solutions free up time for face-to-face interaction with the elderly are evidently also difficult to confirm (Karhinen et al., 2019), underscoring the complexity in interactions between the elderly and service providers and the critical importance of the municipalities' purchasing competence and training capacity when implementing digital solutions.

As one of the most digitalized service industries, our final sector, *banking*, also depends on specific qualifications and increased awareness of accountability and regulations. Also here, the introduction of digital networks, the digital capacity to administrate client data and the automation of manual tasks have gone hand in hand with strong, long-term growth in demand. In parallel, the recent financial crunch and adoption of new digital services have triggered stricter European and national financial services regulations. After massive restructuring and downsizing in the 1990s, the long-term growth in the demand for financial services has, in spite of digitalization and productivity growth, contributed to a certain stabilization of Nordic banking employment in the new millennium. Danish and Icelandic banking suffered large job losses after the financial crunches there, but overall bank employment has also flattened in the other Nordic countries, and several traditional bank occupations have seen job decline. Our pilot study has identified three forms of digital transformations that are crucial to the changes in banking. *Firstly*, the financial sector has led the way in the automation of supporting tasks and administrative operations that lend themselves to automation (Frey and Osborne, 2017). *Secondly*, the advance of digital technology has helped banks provide new services at distance via web-based communication and self-service. *Thirdly*, digitalization facilitates the emergence of "ecologies" of highly specialized financial actors, competing and sharing data with each other (Cai, 2018), where the entrance of the Big Tech corporations represents an imminent challenge. While automation obviously leads to decline in several traditional bank jobs – often held by women – the expansion of net-based services replaces conventional face-to-face customer services, but propels demand for staff in ICT-maintenance, service innovation and more advanced sales functions. The emergent ecologies of interdependent financial actors require more staff able to develop businesses dependent on data-sharing and



a dynamic technological infrastructure within ever more complex regulative frameworks. Together, these changes not only foster decline in certain routine skills, but also require new and more qualified skills in, for instance, computing, information security, compliance and regulation (Cai, 2019). Since the gender balance within the occupation appears fairly stable, the occupational changes and subsequent upgrading of staff skills indicate that less educated women – often with high tenure – are replaced by higher-skilled, supposedly younger women.

In contrast to the mushrooming studies of casual service work in the new digital platform economy (see Jesnes and Oppegaard et al., 2020), we have in this exploratory study focused on the impact of digitalization on work in traditional service sectors, accounting for a large share of ordinary jobs in the Nordic labour markets. As shown, all of these traditional service industries – retail, elderly care and banking – have for quite some time been adopting new digital technologies, influencing the pattern of work and demand for labour and skills. Common to all three examples is that the introduction of digital technologies has enabled the development of new and supposedly better or more customer-/client-friendly services, whereas expanding demand for the respective services so far has compensated for the labour-saving effects of the new technologies and contributed to relatively stable development in overall employment. As such, this is a good illustration of how digital technology influences service work and employment. In most instances, new technology enables the provision of more and/or better services with the same or less labour input (Dieppe et al., 2020). A common lesson from all three industries, however, is how dependent the employment effects are on the development in demand for the services in question, which in turn is associated with the rate of economic growth. Irrespective of the pace of technological change, employment in retail and banking has oscillated with the economic bust and boom cycles, while ageing and popular demand have prompted politicians to allocate increased budgetary resources and labour to elderly care. While the main motive for introducing new technology in a given company or industry is to enable production of more or better services with the same or less input of labour, the societal gain is that this can free up labour, skills and economic resources to resolve other prioritized political or economic tasks.

As emphasized in Chapter 2, the overall job effect of digital rationalization in these three large sectors of service employment can therefore not be assessed solely on basis of the impact within each (which may well be negative in the coming years in retail and banking). It also depends on whether the value added generated by the gains in productivity is utilized in ways – either through consumption or investment – that generate an increase in labour demand elsewhere in the domestic economy that is larger than the initial labour-saving effect. If the value added is spent on consumption or investment in production of other more labour-intensive services – which, to a large extent, has been the case in the era of post-industrial job growth – the net employment effect can indeed be positive. That might also be the case if the value added is invested in more technology-intensive industries with higher labour productivity, given that the employment multiplier effects of increased economic growth exceed the initial labour savings in our three sectors. In other words, as long as there is economic growth and rising demand for many labour-intensive services, there is no principled economic reason why the adoption of labour-saving digital technologies *per se* should necessarily lead to lower levels of overall service employment.

That said, there are many caveats that may prevent such a virtuous scenario of persistent growth in service employment. As discussed in Chapter 2, it is clear that, apart from customer preferences, continued growth in the demand for services and service labour is contingent on a range of relative prices, not least on labour, production facilities and the price of end services, as well as on the development of different consumer/customer groups' purchasing power. Premised on economic growth, the latter is importantly influenced by the overall distribution of income and wealth in society. As these are issues that the Nordic political economies have proven able to sort out in the past, and are not specifically related to digital technology, we will not dwell on these issues further (see the final chapter).

What will certainly be a challenge flowing from the digital transformation, however, is to enable the adaptation of the workforce to the changing demand for skills – not only in the cases discussed in this chapter, but also in the wider labour market. Largely in line with the findings in Chapter 3 regarding the overall pattern of occupational change, our qualitative analyses suggest that all the three traditional services sectors are predominantly characterized by the upgrading (rather than the polarization) of work. To a different extent, the three sectors also face shortages of labour with the required expertise to handle the digital development. In retail, the share of jobs in managerial and specialist occupations is increasing, and even frontline retail jobs are slowly shifting away from manual routine tasks towards more elaborate customer interactions and personalized service (Steen et al., 2019); this may also entail a change in the balance of men and women employed in retail. In banking, many traditional tasks are being replaced by digital solutions, whereas the share of staff with specialized expertise in ICT design, business development and regulatory compliance is growing. Also in elderly care, interviewees describe how different forms of digitalization foster demand for increased competences to tackle, for instance, needs for systemic maintenance and upgrading, procurement and more complex privacy regulations.

In short, it seems that in these three traditional sectors accounting for a sizeable share of Nordic service employment, digitalization is contributing to strengthened demand for higher-skilled labour and an increased emphasis on cognitive and interpersonal/communicative skills among the core, frontline staff. Accordingly, the share of manual routine work with low skill requirements – typical entry jobs – has seemed to dwindle. In view especially of the retail sectors' role as an engine for the inclusion of young people, female re-entrants, immigrants and other vulnerable groups in the labour market, this suggests that policies to promote skill formation, on-the-job training, retraining, job placement and active labour market measures will become increasingly important to develop an inclusive digital future of work.

# Chapter 6: Summary - Digital change and continuity in the Nordic Future of Work project

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## 6.1 Introduction

By exploring the effects of digital change in traditional work, a central aim of this report has been to make it possible for readers to assess critically what sometimes appears to be rather dramatic claims concerning the impact of digitalization on work in a Nordic context. We have presented a set of empirically grounded studies, examining general trends on the Nordic labour markets as well as different Nordic cases of digitalization comprising sectors such as manufacturing, retail, elderly care and banking. These studies are conducted with an eye to the effects of digitalization on jobs, occupations and employment relations in the conventional part of the labour market, thereby facing the stakeholders (e.g. employers, unions, governmental bodies) who try to govern this change. Reflecting the complexity of the topic, these studies have been explorative by nature and guided by a mixed-method approach. Some of them have drawn on statistical analysis of aggregated data for the whole workforce, making it possible to look closer at the development of the occupational structure in the Nordic countries over time. Other studies have built on qualitative investigations, making it possible to explore how stakeholders in the different Nordic countries respond to demands for digital change.

By applying an explorative approach, the studies recognize that this is a domain of research in constant change, and that we may only be in the beginning of what researchers sometime describe as the Fourth Industrial Revolution (Schwab, 2016). As we have only seen what may turn out to be the initial consequences of the current wave of digital transformation thus far, there is reason to treat the results in the report as preliminary. By exploring traditional forms of work from different angles, each chapter nevertheless points to a set of developments that have implications for the organization of Nordic working life in the increasingly digital future. In so doing, the studies suggest that digital transformation is associated with considerable institutional continuity, cautioning against claims that digitalization will completely transform or disrupt Nordic working life.

In the remainder of this chapter, we summarize the main take-home lessons from each chapter and then briefly discuss their broader implications.

- **Digital transformation has thus far not led to reduced employment, slower job growth or increased labour productivity growth in the Nordic economies.** Chapter 2 described how employment and productivity in the Nordic countries have developed during the past 20–30 years of increased digitalization. While confirming that new digital technologies have contributed to reduced

employment growth and labour intensity in several industries – for instance, retail, banking, manufacturing and other tangible goods production – the chapter shows that insofar as there has been economic growth, total job growth has remained quite stable. This indicates that the economic gains of technological rationalization in some industries have so far contributed to increased demand and employment in other industries, predominantly in the services sector, which have shown steady, long-term growth. Thus, the spectre of massive digital job destruction has not materialized. Especially male employment has been sensitive to cyclical fluctuations, however, mirroring developments in sectors like manufacturing and construction. As a whole there are no indications that the ongoing digital transformation as yet has led to reduced overall employment, slower job growth or any clear trend towards stronger growth in labour productivity in the Nordic economies, neither in manufacturing nor in the business services sector. However, whether these retrospective observations are indicative of future trends or merely reflect that the digital transformation is still in its infant stage where the heralded effects on employment and productivity are yet to come, is indeed too early to say. As illustrated by the financial crisis and the corona shock, it is quite clear that the employment impact of fluctuations in economic growth has hitherto been much more salient than the impact of digitalization of production and work.

- **There has been a tendency towards the upgrading of the occupational structure of employment in most Nordic countries, except Denmark.** Reviewing the main findings from a study we have undertaken of changes in the occupational structure of employment in Denmark, Finland, Norway and Sweden from 2000 to 2015, based on Labour Force Survey data, Chapter 3 showed that the changes vary somewhat between countries and sectors. Changes in Denmark were clearly moving towards polarization, that is, the most job growth at the top and bottom of the occupational structure accompanied by declining employment in middle-placed occupations. In Finland, Norway and Sweden, the trend was towards upgrading, i.e. rising employment shares in occupations with high pay and skill requirements and decreasing employment shares in occupations with low pay and skill requirements. The tendency towards upgrading was found in both the public sector and manufacturing and other forms of goods production. Contrary to the expectation fuelled by the polarization thesis, a similar upgrading pattern was also found in the services sector as whole, which has been the main engine of employment growth since the turn of the century. This has especially benefitted women who have seen strong employment growth in the middle and upper parts of the occupational structure (2011-2015), and decline in the low end. Males, by contrast, have seen a more mixed pattern of change with a pronounced polarization in Sweden – only growth in the top and the bottom – and only growth in the upper end in Norway.<sup>26</sup>
- **While digitalization blurs existing boundaries between white- and blue-collar workers, organizational stakeholders continue to link different digital technologies and upskilling opportunities with different groups of employees.** Chapter 4 drew on a qualitative study of companies in the manufacturing

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26. Data for Finland and Denmark were for practical reasons unavailable at the time of writing.

sector, which constitutes the corner-stone of the Nordic labour market models. Based on 65 interviews with representatives of plant management, local trade unions and employees at eight industrial sites in Denmark, Sweden, Norway and Finland, the study examined the micro-level processes that condition different priorities and organizational responses to the emerging demands for digital skills, changes in work organization and upgrading of work in practice. For the predominantly male blue-collar workers, where unskilled jobs tend to disappear (or be outsourced), the changes in job content, skill requirements, job demarcations and occupational safety and health conditions were mainly perceived as an upgrading of work (for those who remained). By moving beyond descriptions of digitalization as a coherent, unitary force and distinguishing between the digitalization of production, administration and communication, the chapter identified significant variation in how the industrial actors respond to the demands for upskilling. While bringing clear prospects for job upgrading among blue-collar workers, white-collar workers did not experience similar opportunities to rise in the occupational structure, but rather, encountered intensified individualized demands to keep themselves updated and agile within existing positions. The chapter concluded that there is a need to look further into different groups of employees' actual engagement with digital tasks and reskilling, examining how their job quality, working environment and employment relations are affected. As broader changes such as the green shift and the recent Covid-19 pandemic also urge many manufacturing companies to restructure and digitalize their production, the demand for policies enabling affected workforces to handle the pressures for reskilling and job mobility will most likely increase in the years to come.

- **Digitalization notwithstanding, growing demand for services has propelled rising service employment – especially in high-skilled service occupations – whereas workers in lesser-skilled routine jobs susceptible to digital rationalization face more uncertain job prospects.** Pointing out that the service sectors account for four-fifths of Nordic employment, Chapter 5 underscored the importance of continued growth in the service economy to maintain employment growth, as the technological transformation in manufacturing and other goods industries brings further employment decline there. By depending on different forms of human interaction with the customers/clients, many service jobs – especially in social and personal services – have thus far been less susceptible to technological rationalization. A range of economic, institutional and behavioural factors influence whether specific services lend themselves to labour-saving digitalization and whether the gains in productivity and value added are exceeding the costs of new digital technologies and reinvested into new jobs. The chapter illustrated this variety by looking closer into three different service industries.
- First, the biggest service industry in terms of employment is retail, as recognized by high shares of female employees and job opportunities for several marginal or low-skilled groups. Despite growth in economic turnover, employment growth has showed signs of stagnation in recent years, most pronouncedly in Finland and Norway (and less pronounced in Denmark). As growing e-commerce and digitalization of routine tasks imply less demand for

manual labour, emphasis is shifting towards customer interaction and personalized service (Steen et al., 2019). Although the demand for higher-skilled staff with expertise in information and communication technologies (ICT) and logistics also may increase, estimations based on Norwegian studies indicate that retail employment will shrink markedly in the future (ibid: 36).

Elderly care also shows high shares of female employment, as well as job opportunities for marginal groups. Providing services shaped by complex social demands and requirements pertaining to qualifications, accountability and regulations, it is less evident how new digital technologies can contribute to make core work tasks much easier or faster. In relation to claims that new digital solutions free up time for face-to-face interaction with the elderly, the chapter not only referred, for instance, to time-saving in the administration and disposal of medicines, but also pointed out that such claims are difficult to confirm (Karhinen et al., 2019). Digitalization was nevertheless seen by the interviewees as a helpful means by which elderly care could better tackle the conflicting pressures from increasing demand driven by ageing, skill shortages and budgetary constraints.

Banking services are also marked by high demands for trust, qualifications, accountability and regulatory compliance, which entail certain limits to digitalization. Pointing out that Nordic banking is in the forefront of digitalization, the chapter described a turbulent development where financial crises and complex combinations of institutional, regulative and technological renewal have caused profound changes in banking work. The possible penetration of the Big Tech corporations into the financial sector, along with the mushrooming fintech niche, bode for further change in the years to come. While overall employment has largely stabilized in the new century, the demand for routine skills have declined because of the digital automation of specific administrative jobs. Net-based services have replaced many face-to-face services, but the development of digital bank services has also increased the demand for skills in maintenance and service innovation, as well as in sales, as aptly indicated by the phrase "from tellers to sellers" (Regini et al., 1999). Influenced also by the emerging digital ecology of interdependent financial actors sharing information, rising demand for more qualified skills, for instance, in information security, IC, compliance and regulations (Cai, 2019), have altered the skill mix and ways of working in banking.

Contrary to the many studies of proliferating low-skilled casual service work through, for instance, digital platform companies (see Ilsøe et al., 2020; Jesnes et al., 2020), the analyses in Chapter 5 suggest that digitalization in these large, traditional service industries moves away from routine manual tasks towards more qualified, communicative tasks. Hence, the studies presented in the chapter are in-line with the findings in Chapter 3, indicating that the services sectors in the digital era are more influenced by tendencies of occupational upgrading than by polarization. This has benefitted the rising share of well-educated women in particular. At the same time many female jobs in low end occupations have become obsolete due to increased use of digitalized self-service provision in sectors like retail and banking. Given the rapid adoption of digital communication, displacing many low-skilled routine jobs in travel, hotels/restaurants and other personal services during the

Covid-19 pandemic (Dieppe et al., 2020), Chapter 5 also points out that recent developments raise questions about the services sectors' future ability to fulfil its past function as engine for labour market inclusion of workers with little formal education, female re-entrants, young people, immigrants and other marginalized groups (Nergaard and Steen Jensen, 2018).

## 6.2 Digital change and continuity at work

By studying how digitalization is influencing employment, work and labour relations at ordinary workplaces in sectors accounting for sizeable parts of Nordic employment, we sought to go behind the narratives of digitalization as a uniform driver of disruptive job destruction and obtain a down-to-earth view of what it means for ordinary Nordic employees. Although the findings are preliminary, the picture emerging is sobering. In sizeable parts of Nordic labour markets, the impact of digitalization is so far less pervasive than we are often told and more marked by gradual adaptation than by paradigmatic, disruptive change, cautioning against technological determinism. In most instances, the diffusion and adoption of digital technology in traditional sectors is taking time and leaving room for the evolutionary, pragmatic adjustment of work practices and institutions.

The role of digital technology in the sectors we looked at differs vastly, as does, apparently, the potential for future change. In banking and manufacturing, which have undergone significant digitalization since the 1980s, current changes appear largely as a continuation of previous trends. In retail, the rise of e-commerce may trigger more sweeping change in the years to come, propelled also by the automation of routine tasks and the entrance of giant digital disruptors such as Amazon. In elderly care, by contrast, ageing increases the demand for labour with warm hands, regardless of the introduction of labour-saving digital tools.

As to the aggregate job effects, the diverse trajectories of digitalization in these industries illustrate that the impact on overall employment cannot be inferred from the direct job effects of technological rationalization "within" single industries, but rather, depends on the indirect shifts in labour demand "between" industries and sectors that it contributes to. As long as the value added resulting from digital change within some sectors is used to boost demand and job-generating investment in other sectors, there is no compelling reason why digital technological change should lead to reduced employment in society. It is precisely such mechanisms that have contributed to the steady rise in employment and the shift from industrial to service work in the Nordic countries since the 1970s, when new technologies and labour were mainly complementary factors. Such virtuous circles have arguably become more difficult to maintain in open, internationalized economies, where rising inequalities, tech giants, tax competition/evasion and investment in assets and property rather than in real production are detracting from national labour demand. In addition, the complementarity between technology and labour is weakened in some branches, most saliently in the branch of tech giants. Yet, as there are plenty of unmet needs in society that consumers, firms and politicians are interested in paying for getting done, the ability to overcome such obstacles rests on the imagination and capacity of politicians and other social actors to develop institutions and policies that can enable people to take advantage of digitalization at work and ensure a fair, productive distribution and use of the gains achieved. This

has been the strength of the Nordic labour market model in the past, and judging from the explorative study referred to in this chapter, there are in principle no technological reasons why this could not also be the case in the changing future of work – even though the political obstacles are admittedly demanding.

To succeed with digitalization projects and reap the mutual benefits thereof, both the employer and the labour interviewees in our case studies underscored that broad participation and worker involvement in the processes of reorganization and upgrading were indispensable. Even when implying a reduced need for labour or burdensome changes in work organization, jobs and skill structure, the union representatives were generally positive towards digitalization, which was considered a necessary means to safeguard competitiveness and jobs or, as in elder care, to cope with rising workloads. Hence, digitalization was subject to surprisingly little controversy. In addition, no concerns that the Nordic model was undermined or becoming obsolete because of digitalization were voiced in any of our cases. On the contrary, representatives of both sides viewed the Nordic model as an important resource and advantage in handling the restructuring and reskilling processes associated with technological change.

That said, by propelling changes in the occupational structure – mostly towards upgrading – the impact of digitalization on the recruitment base of labour unions differs markedly. While the decline in the constituencies of manual labour unions anchored in physical production seems to persist, the higher educated base of white-collar associations is steadily growing in both the private and public sectors. The prospects for organizations in routine-based services occupations appear much bleaker, also because these parts of the labour market stand out with higher shares of nonstandard jobs and a lower propensity to unionize (Ilsøe et al., 2020). In such a scenario, altering power relations and conditions for co-ordination in collective bargaining and political arenas, the organizations of groups in most need of protection risk losing ground and clout, while those of the better off gain strength and influence (see Andersen et al., 2014). Insofar as occupational restructuring also seems to weaken job prospects and strengthen job competition for groups with limited education and skills – undermining their individual negotiating position – there is an imminent risk that digitalization will reinforce the rise in inequality of wages, working conditions and labour market opportunities in the Nordic countries. The marked growth in wage dispersion in the lower half of the Norwegian labour market in past decades, along with the steep decline in the employment rates of especially male labour with limited skills/education, is a case in point in this respect.

Whether digitalization fuels further upgrading or polarization of the job structure, or mixes of both in different parts of the labour market (Eurofound, 2017), the findings of our study suggest that the restructuring and occupational mobility propelled by digitalization will cause widened skill gaps and mismatches in the labour market. To meet changing employer demands and enable newcomers and workers with dated skills to move into areas with skill and labour shortages, digitalization will thus strengthen the need for active labour market policies, mobility-enhancing support, and investment in vocational education and training, reskilling, job training and lifelong learning in a range of areas. Policy-making will have to consider different activation measures and provide tools that allow employees to tackle an increasing demand for mobility. Such policy measures are particularly important for the parts of the workforce whose skills become redundant due to digital rationalization, but also for the large shares of the incumbent workforce that will need to update their digital and other skills to master the changing task requirements in their present



jobs or occupations. Confirming the results of previous studies linking digitalization with the consequences of a green shift that hits male- and female-dominated parts of the labour market differently (Eurofound, 2019b), the findings in this report indicate that any such policy measure also has to be sensitive to gender differences.

As the case studies referred to in this chapter deliberately focused on the impact of digitalization in traditional realms of working life, where the Nordic model remains solidly anchored, our preliminary findings are not necessarily representative of other parts of the labour market, where the incidence of atypical or novel forms of work is higher (see Chapters 4 and 5, Ilsøe et al., 2020; Jesnes and Oppegaard, 2020). Yet, by exploring how actors in traditional corner-stones of the Nordic working life model are responding to digitalization, we have caught a glimpse of the model's robustness and adaptability within its core realms, where we found little evidence of disruptive break-ups from former work practices. The dominant picture was rather one of gradual, incremental adjustment and institutional continuity, where digitalization does not occur as a uniform force of irresistible change – a "*deus ex machina*" – but rather, opens for a range of applications and adaptations in different contexts, leaving scope for human response, strategic agency and choice. The manner in which digital technologies are used, for what purposes and the resulting consequences, appear in most instances to be influenced substantially by social actors and the organizational, institutional and political contexts in which they are applied. Hence, digitalization not only is a technical process, but also involves broader social and organizational processes where the connection between digital technologies and the organization of work is a two-way relationship substantially influenced by the institutional–political frameworks within which it evolves. From our explorative empirical observations, it also seems that the actors in the core of the Nordic working life model are able to influence this relationship in ways that can be both instrumental and compatible with the *modus operandi* of the model.

Thus, the analyses in this report suggest that there is reason to treat the widespread argument that digitalization is causing massive job destruction and disruptive transformation of work with caution. As pointed out long ago by John Maynard Keynes (1932), it is important to bear in mind that changes in working life are shaped by many factors other than technology. The impact of institutional and political frameworks matters, and fosters different degrees of path dependency, or what scholars described as institutional continuity (cf. Thelen, 2009). In addition, the past decade's two major economic crises remind us that that economic factors still matter a lot. The developments in Nordic employment in the past decades have clearly been much more affected by cyclical swings and economic crises, caused by financial and macro-economic policy failures, than by technological change. When finishing up this report, the Covid-19 pandemic has also unleashed a dive in the world economy and employment unparalleled in modern time. Although the Nordic economies at present appear to catch up fairly well, unemployment is expected to remain high for several years and the problems in key service branches and the dive in international demand for central Nordic export products, will hardly be easy to overcome. How the Covid-19-crisis in the end will influence labour markets and the digitalization of work, is too early to judge. It is evident that that the pandemic has accelerated the digitalization of work and communication in several service branches (Dieppe et al., 2020, Navrebjerg and Minbaeva, 2020). The pandemic may also represent opportunities to speed up the green shift, spurring introduction of more sustainable digitalized modes of production. While digitalization require increased investments, the Corona-crisis has nevertheless prompted a plummeting of

investment internationally and nationally. Thus, the impact of the Corona-crisis' on digitalization can be expected to be ambiguous or contradictory, clearly giving impetus to faster digitalization of communication but, perhaps more importantly, leading to reduced growth in the investments needed to speed up the digital and green shift in our modes of production. While politicians of all colours have seen the need for resolute state efforts to keep up popular consumption during the crisis, suggestions that the state should also take a more active role in boosting investment in new digital, green technologies and infrastructure to overcome the slump have proven more contentious. Clearly, technological innovation is only one but several elements in the broader socioeconomic and political processes shaping future of work.

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# Sammanfattning

Forskning och offentlig debatt om digitaliseringens betydelse för de mer etablerade delarna av arbetslivet framhåller regelbundet teknologins omvälvande effekter. Det tycks vara en disruptiv teknologi som i takt med att våra arbeten förändras också får etablerade institutioner och former för policy-making att framstå som allt svårare att förlita sig på. Följande TemaNord rapport består av ett antal empiriskt grundade studier av den digitalisering som fortgår i det Nordiska arbetslivet. Det är explorativa studier som syftar till att underlätta för läsaren att kritiskt förhålla sig till argumenten om en omvälvande förändring i ett Nordiskt sammanhang. Rapporten tar fasta på att de Nordiska länderna, med såväl utvecklade digitala infrastrukturer som stabila välfärdsarrangemang, utgör ett intressant sammanhang för studier av digitaliseringen och dess betydelse för arbetets organisering, partsrelationer, arbetstillfällen, och anställningars utformning.

Efter att ha ramat in och introducerat rapportens studier i kapitel 1, följer kapitel 2 där rapporten undersöker den utveckling som präglat arbetstillfällen och produktivitet i de Nordiska länderna under de senaste 20 till 30 åren av digitalisering. Kapitlet bygger på empiri som sträcker sig till början av 1990-talen och den introduktion av Internet som ägde rum ungefär vid den tidpunkten. Ett flertal empiriskt grundade reflektioner presenteras kring möjliga faktorer som kan förklara digitaliseringens effekter på de antal arbetstillfällen som kan tillkomma i framtiden. En slutsats som dras är att det inte finns några indikationer på att den pågående digitaliseringen har reducerat antal arbetstillfällen eller begränsat tillväxten av antal arbetstillfällen i de Nordiska ekonomierna. Inte heller går det påvisa att det finns någon tydlig ökning i produktivitet inom varu- och tjänsteproduktion som kan förklaras med introduktionen av digital teknologi. Samtidigt betonar rapporten att teknologin inom vissa specifika branscher ändå har haft betydelse på så vis att antalet arbetstillfällen krymper och att en mindre arbetskraftsintensiv produktion tar form.

Kapitel 3 går sedan igenom en studie av de förändringar som präglat den yrkesstruktur som återfinns i Danmark, Finland, Norge och Sverige 2000–2015. Baserat på data från ländernas arbetskraftsundersökningar, visar kapitlet hur dessa förändringar varierar något mellan länderna. Inte minst Danmark präglas av en utveckling mot en mer polariserad arbetsmarknad, d.v.s. att de arbetstillfällen som ökar i antal återfinns i de lägre skikt som kräver låga kvalifikationer, och i de högre skikt i yrkesstrukturen som kräver mer kvalifikationer, medan antalet arbetstillfällen däremellan minskar. I Finland, Norge och Sverige präglas trenden däremot av en tydligare uppgradering, d.v.s. att arbetstillfällen som kräver mer kvalifikationer och som har högre löner ökar i antal, medan de med krav på lägre kvalifikationer och lägre lön minskar. Denna uppgradering återfinns i både offentlig sektor och tillverkningsindustrin. Till skillnad mot de förväntningar på ökad polarisering som ibland framförs, pekar studien även på att tjänstesektorn generellt präglas av uppgradering. En slutsats som är viktigt med tanke på att tjänstesektorn står för en stor del av de arbetstillfällen som tillkommit de senaste årtiondena.

Kapitel 4 bygger på en kvalitativ studie från tillverkningsindustrin, dvs. en sektor som spelat en stor roll för de arbetsmarknadsregimer som över tid vuxit fram i de små

men öppna Nordiska ekonomierna. Det rör sig om 65 intervjuer med företrädare för den lokala ledningen vid olika industrier, fackliga företrädare, och anställda vid åtta industrier i Danmark, Sverige, Finland och Norge. Studien undersöker de processer som fortgår i den löpande verksamheten. Det är processer som präglar olika prioriteringar och beslut rörandes arbetskraftens behov av digital kompetens, och som i olika utsträckning även får betydelse för personalen möjligheter att genomgå någon form av uppgradering. Genom att röra sig bort från generella beskrivningar av digitaliseringen som en samlad kraft, och urskilja olika former av digitalisering (av produktion, av administration och kommunikation), beskriver kapitlet hur olika aktörer förhåller sig till krav på kompetensutveckling. En relativt klassisk syn på uppgradering framträder i relation till de arbetstillfällena som förknippas med arbetare, medan tjänstemän inte förknippas med samma möjligheter till strukturell uppgradering, utan förväntas sköta sin kompetensutveckling individuellt.

Kapitel 5 visar att utvecklingen av tjänstesektorn fortsätter att vara viktig i samband med att den teknologiska utvecklingen begränsar de antal nya arbetstillfällena som tillkommer inom varuproduktion. Genom att tjänstesektorn förutsätter olika former av social interaktion med kunder och klienter, är det emellertid en sektor där digitaliseringen inte kan spela samma roll för den rationalisering och ökning av produktivitet som förknippas med varuproduktion. En rad ekonomiska, institutionella och beteendemässiga faktorer får betydelse för huruvida den produktivitet som uppnås medför vinster som överskrider kostnaderna för den nya teknologin, och om vinsterna kommer att återinvesteras på ett vis som leder till nya arbetstillfällena. Kapitlet tar fasta på de skilda villkor för användningen av digital teknologi som återfinns i detaljhandel, äldreomsorg och banktjänster. Till skillnad mot studier som undersöker de nya tjänster som växer fram inom plattformsekonomin, visar kapitlet att dessa mer konventionella delar av tjänstesektorn präglas av en utveckling från rutinarbete mot mer kvalificerade uppgifter. Det är en utveckling som ligger i linje med de resultat som presenteras i kapitel 3, men som också reser frågor om tjänstesektorns möjligheter att i framtiden vara den del av arbetsmarknaden som inkluderar arbetskraft med lägre formella kvalifikationer, yngre, invandrad arbetskraft eller andra mer marginaliserade grupper.

Kapitel 6 summerar de resultat som återfinns i de olika kapitlen samt diskuterar hur dessa resultat på olika vis beror på institutionella, ekonomiska och beteendemässiga villkor. Kapitlet framhåller att de studier som presenteras på skilda vis betonar betydelsen av just bredare socioekonomiska förutsättningar. Att teknologin är kraftfull hindrar följaktligen inte att den digitala förändring av det Nordiska arbetslivet som pågår kännetecknas av kontinuitet i hur organisationsförändringar, normer, arbetsinnehåll, politiska åtgärder och regleringar utformas. Även om det finns skäl att diskutera digitaliseringen som en omvälvande kraft, drar kapitel 6 slutsatsen att den Nordiska utvecklingen präglas av institutionell kontinuitet och att forskare och beslutsfattare (inom såväl näringsliv som politik) bör vara försiktiga och förhålla sig kritiskt till de mer disruptiva digitala scenarier som med jämna mellanrum får genomslag i debatten.



# Appendix 1

**Table 2.1 underpinning Figure 2.3 (in Chapter 2) (A) Average annual employment growth in 5-year periods, 1980–2018, and (B) the ratio of employment growth on GDP growth in the same periods (Source: OECD.stat; LFS, National Accounts for 2005–2010)**

Employment Average annual change %

	1980–1985	1985–1990	1990–1995	1995–2000	2000–2005	2005–2008	2008–2010	2010–2018	1980–2018
<b>Denmark</b>	0.54	0.9	-0.4	0.9	0.1	1	-1	0.7	0.4
<b>Finland</b>	0.9	0.5	-3.2	2.3	0.5	1.3	-1	0.1	0.3
<b>Iceland</b>	2.8	1	2.5	1.9	0.4	2.1	-1.9	2.5	1.8
<b>Norway</b>	1.2	0.1	0.5	2	0.2	1.2	-0.2	0.9	0.96
<b>Sweden</b>	0.3	0.9	-2.2	0.9	0.9	1.1	-0.3	1.3	0.5

Average annual GDP growth per cent

	1980–1985	1985–1990	1990–1995	1995–2000	2000–2005	2005–2008	2008–2010	2010–2018	1980–2018	Average
<b>Denmark</b>	1.86	1.72	2.04	2.84	1.62	2.4	-5.4	0.34	1.85	1.75
<b>Finland</b>	3.2	4	-1.1	4.8	3.4	4	-7.3	0.96	0.13	2.06
<b>Iceland</b>	2.82	3.7	1.5	4.3	3.76	7	-4.8	3.2	2.94	3.2
<b>Norway</b>	3.3	2.4	3.3	3.8	2.3	2.7	-1.2	1.3	1.8	2.6
<b>Sweden</b>	1.9	2.7	-0.1	3.46	3	3.6	-4.4	1.3	3	2.2
<b>Average</b>	<b>2.7</b>	<b>2.9</b>	<b>1.1</b>	<b>3.8</b>	<b>2.8</b>	<b>3.9</b>	<b>-4.6</b>	<b>1.4</b>	<b>1.9</b>	<b>2.36</b>

Ratio average employment growth over average GDP growth (proxy for employment intensity of growth)

	1980–1985	1985–1990	1990–1995	1995–2000	2000–2005	2005–2008	2008–2010	2010–2018	1980–2018
<b>Denmark</b>	0.29	0.52	-0.2	0.32	0.06	0.4	0.2	0.38	0.23
<b>Finland</b>	0.28	0.13	2.9	0.48	0.15	0.4	0.1	0.77	0.19
<b>Iceland</b>	1	0.27	1.67	0.44	0.11	0.3	0.4	0.85	0.56
<b>Norway</b>	0.36	0.04	0.2	0.52	0.09	0.4	0.2	0.5	0.37
<b>Sweden</b>	0.16	0.33	(SE=22)	0.26	0.3	0.3	0.1	0.43	0.23
<b>Average</b>	<b>0.41</b>	<b>0.23</b>		<b>0.42</b>	<b>0.14</b>	<b>0.4</b>	<b>0.2</b>	<b>0.7</b>	<b>0.34</b>

# Appendix 2

**Table 3.1: Changes in the occupational wage structure of persons in employment aged 16–64 years, 2011–2015, weighted data, underpinning Figures 3.1 and 3.2 in Chapter 3.**

Total employment 16–64 years	2011 Per cent	2015 Per cent	Percentage point difference 2011-2015	Per cent change (numbers) 2011-2015	Change in numbers (1000s) 2011-2015
<b>Denmark</b>					
1 <sup>st</sup> quintile (lowest)	20.0	20.8	+0.8	5	26
2 <sup>nd</sup> quintile	20.7	19.6	-1.1	-4.3	-23
3 <sup>rd</sup> quintile	19.8	18.3	-1.5	-6.6	-34
4 <sup>th</sup> quintile	19.6	21.2	1.6	9.3	47
5 <sup>th</sup> quintile (highest)	19.9	20.2	+0.3	2.7	14
Total	100	100			
N (in thousands)	2,599	2,630		1.2	31
<b>Finland</b>					
1 <sup>st</sup> quintile (lowest)	20.9	20.3	-0.6	-4.5	-20
2 <sup>nd</sup> quintile	19.0	18.3	-0.7	-5.5	-22
3 <sup>rd</sup> quintile	20.2	20.0	-0.2	-3.1	-13
4 <sup>th</sup> quintile	19.7	20.3	+0.6	+0.7	+3
5 <sup>th</sup> quintile (highest)	20.2	21.1	+0.9	+2.1	+9
Total	100	100			
N (in thousands)	2,113	2,070		-2.0	-43
<b>Norway</b>					
1 <sup>st</sup> quintile (lowest)	21,5	19.6	-1.8	-5.8	-30
2 <sup>nd</sup> quintile	17.5	17.0	-0.9	-2.4	1
3 <sup>rd</sup> quintile	19.3	18.8	-0.4	0.9	5
4 <sup>th</sup> quintile	21.7	22.2	0.7	6.2	33
5 <sup>th</sup> quintile (highest)	20.0	22.4	2.5	15.7	78
Total	100	100			
N (in thousands)	2,446	2,521		3.1	74.9

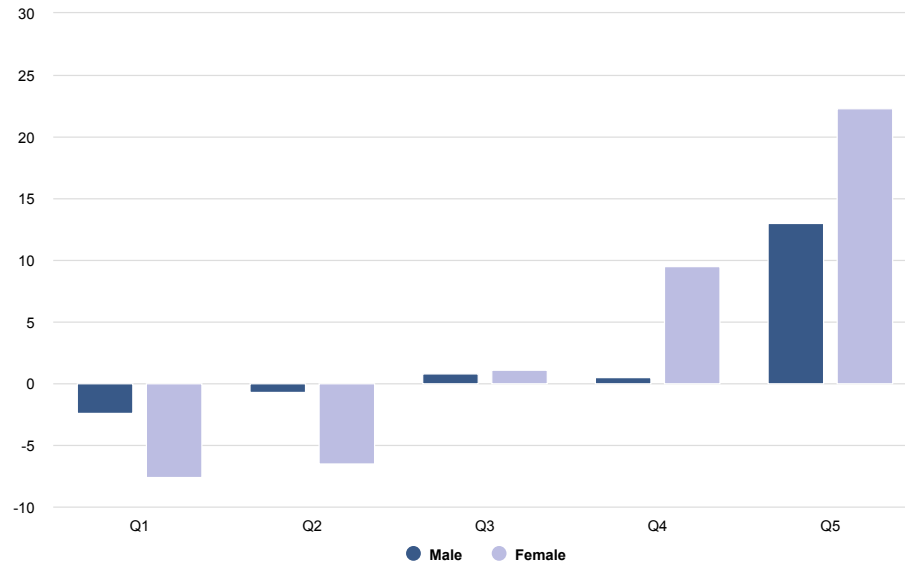
Sweden					
1 <sup>st</sup> quintile (lowest)	20.5	19.9	-0.6	0.2	1
2 <sup>nd</sup> quintile	22.2	20.9	-1.3	-2.6	-26
3 <sup>rd</sup> quintile	18.4	18.2	-0.2	2.1	17
4 <sup>th</sup> quintile	21.0	21.5	0.5	6.2	59
5 <sup>th</sup> quintile (highest)	17.9	19.6	1.7	13.4	108
Total	100	100			
N (in thousands)	4,482	4,641		3.5	159

# Appendix 3

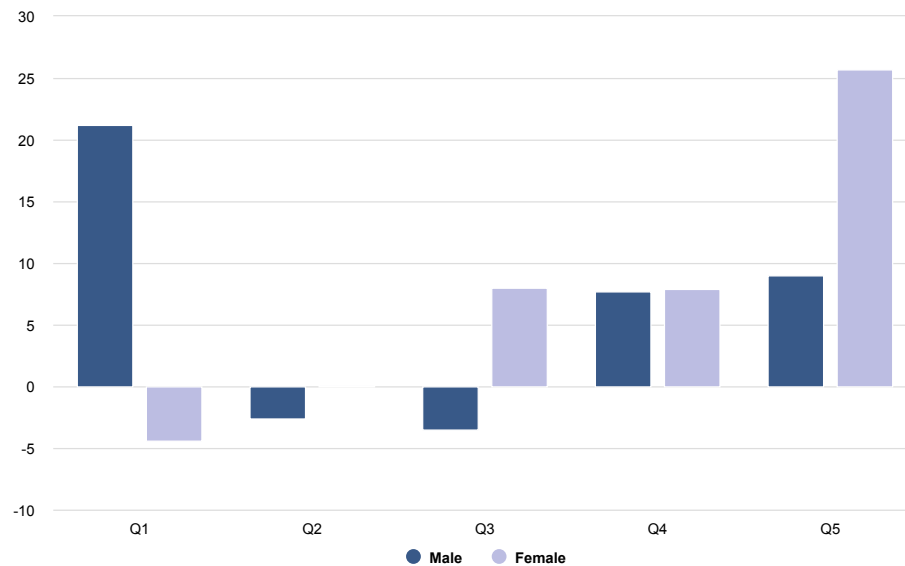
**Table 3.2: Distribution within selected quintiles in 2015 (2016 in Finland). Persons in employment, weighted data (per cent)**

		Denmark			Finland			Norway			Sweden		
		1 <sup>st</sup>	3 <sup>rd</sup>	5 <sup>th</sup>	1 <sup>st</sup>	3 <sup>rd</sup>	5 <sup>th</sup>	1 <sup>st</sup>	3 <sup>rd</sup>	5 <sup>th</sup>	1 <sup>st</sup>	3 <sup>rd</sup>	5 <sup>th</sup>
<b>Sex</b>	Male	42.0	56.8	64.1	31.6	60.7	61.8	36.5	53,3	69.3	28.0	43.6	58.0
	Female	58.0	43.2	35.9	68.4	39.3	38.2	63.5	46,7	30.7	72.0	56.4	42.0
<b>Age (years)</b>	16–24	33.6	11.0	3.0	26.5	11.4	1.8	30.3	13.6	1.7	20.2	8.7	2.2
	25–34	19.6	20.9	22.5	22.4	24.6	23.8	21.9	22.3	20.1	21.0	22.7	22.5
	35–44	17.3	25.4	31.1	16.4	23.7	31.9	17.1	22.1	30.0	18.2	24.5	30.9
	45–54	18.2	24.7	28.4	18.8	23.7	26.8	17.5	23.9	28.8	21.6	24.9	27.7
	55–64	11.3	18.0	15.0	15.9	16.7	15.7	13.3	18.2	20.0	18.9	19.2	16.9
<b>Origin</b>	Native	80.1	92.7	88.1	-	-	-	-	-	-	72.2	85.5	83.8
	EU-28	5.6	3.0	5.0	-	-	-	-	-	-	6.1	5.5	6.9
	Non-EU	14.3	4.3	6.9	-	-	-	-	-	-	21.7	9.0	9.3
<b>Education</b>	Primary	36.7	14.0	4.3	17.4	12.3	3.2	36.3	18.3	4.7	15.7	6.7	2.3
	Secondary	49.3	51.3	24.1	66.2	48.8	12.0	50.5	57.7	29.4	62.4	39.2	17.9
	Tertiary	11.3	34.0	71.0	16.4	38.9	84.7	12.4	23.8	65.9	21.9	54.1	79.8
	No answer	2.7	0.7	0.6				0.8	0.1	0			
<b>Working time (hours)</b>	1–14	24.5	5.0	2.1	10.1	4.6	2.7	19.9	5.8	1.4	8.6	3.7	1.5
	15–29	14.7	7.3	3.3	20.0	11.1	9.3	21.0	13.8	2.8	15.7	6.9	3.4
	30+	60.8	87.7	94.6	69.9	84.3	88.1	59.1	80.4	95.9	75.7	89.5	95.1
<b>Contract</b>	Temporary	10.1	8.8	6.5	21.7	14.0	10.0	12.1	8.7	4.2	28.5	12.7	8.0
	Non-temp	89.9	91.2	93.5	78.3	86.0	90.0	87.1	90.9	95.7	71.5	87.3	92.0

# Appendix 4



**Figure 3.3: Per cent change of the number of employed in different occupational wage quintiles 2011 and 2015 in Norway. Data: The Labour Force Survey.**



**Figure 3.4: Per cent change of the number of employed in different occupational wage quintiles 2011 and 2015 in Sweden. Data: The Labour Force Survey.**

# Appendix 5

## Notes on the methods and empirical materials in Chapter 4:

All of the companies in this study have implemented digital solutions that in one way or another can be described as examples of the aforementioned Industry 4.0 initiatives. The study comprises eight multinational corporations in Denmark, Finland, Norway and Sweden, mainly involved in business-to-business production of a variety of advanced machinery, ranging from the global export production of different types of engines to advanced pumps and drilling equipment. Some of the companies provide some of the oldest still thriving industrial settings in Nordic manufacturing. To enhance opportunities for comparison, all the investigated units belong to the machinery industry. The first Swedish unit produces mechanical components crucial for a variety of machinery, and the second Swedish unit and one of the Finnish units are engaged in the manufacturing of vehicles. The second Finnish unit produces health-care equipment, whereas one of the Norwegian units produces engines for air traffic. Both the Danish and the second Norwegian site eventually produce advanced equipment used in various sorts of extraction, pumping, drilling and so forth. The sample of companies included in the study thus spawns a range of machinery products that demand a high level and variety of skills and knowledge. Table 4.1 describes the selected companies in greater detail.

Companies and type of production	Approx. share of employees	Number of interviews	Interviewees
Swe1: Mechanical components vital for all sorts of machinery	40% blue-collar workers, 35% white-collar workers in production and 25% managers	22	Managers, union representatives, central social partners, web pages, policy documents, etc.
Swe2: Vehicles and construction equipment	80% blue-collar and 20% white-collar workers	5	Specialists, representatives for local unions, central social partners, web pages
Fin1: Vehicles used for professional purposes	65% blue-collar and 35% white-collar workers	4	Production manager, supervisor and chief shop steward, HR manager, annual reports, product information, company website
Fin2: Health-care equipment	40% blue-collar and 60% white-collar workers	2	Production manager and chief shop steward, policy and online documents
Dk1: Advanced equipment used in various sorts of extraction, pumping and drilling	82% blue-collar and 18% white-collar workers	15	Managers, employees, representatives for local unions and shop stewards, central social partners
Dk2: Advanced equipment used in extraction, pumping and drilling	40% blue-collar and 60% white-collar workers	10	Managers, employees, representatives for local unions and shop stewards, central social partners
Nor1: Engines for airplanes	25% blue-collar and 75% white-collar workers	2	Director of digitalization and blue-collar union representative, plant visit
Nor2: Advanced equipment used in extraction, pumping and drilling	60% blue-collar and 40% white-collar workers	5	Managers, shop steward of a blue-collar union, project leader, company web pages, videos and documents

**Table 4.1: Company cases and interviews**

The analysis draws on 65 semi-structured interviews with managers, employees and union representatives at eight manufacturing sites within these corporations. When conducting the interviews, we followed a semi-structured interview guide organized around a set of core themes and questions that allowed us to follow up flexibly on arising issues. One of the Swedish companies was used as a pilot, enabling us to test the interview guide on more than 20 representatives of management and trade unions (Hjelm, 2018). The guide made it possible to identify the objectives and drivers behind different implemented digital solutions, the role of specific employee groups therein and the benefits and consequences resulting from such processes in terms of changes in jobs, skills, work content/situation, working environments and employment relations. The interview data were triangulated with analyses of documents and online material, which were summarized into national case reports. This chapter draws on the joint findings from these national reports. In the analysis, we set out to be explorative as well as sensitive to variations between the different companies. Differences in the number of interviews conducted at each company, nevertheless, constrained our ability to conduct a proper multi-case comparison or draw conclusions explained by the different national contexts. In addition, this was a qualitative analysis, which made it difficult to draw general conclusions about Nordic manufacturing. However, we were able to identify themes of concern recurring across these different Nordic companies, indicating topics that further research may investigate in greater detail.

# Appendix 6

## Notes on the methods and empirical materials in Chapter 5:

In Chapter 5, the section on retail is mainly based on a report from a project on digitalization and skill demand in Norwegian retail conducted by Fafo and Samfunnsøkonomisk Analyse (Steen et al., 2019). The project was commissioned by The Norwegian Union of Commerce and Office Employees (HK) and the Norwegian Labour and Welfare Administration (NAV), and included statistical and econometric analyses of employment data, a literature review of research on how new technology affects skill demand and employment in retail, and six company case studies in Norway. The case studies were based on interviews with local- and corporate-level managers, trade union representatives and regular store employees. The section on retail in Chapter 5 summarizes the main findings from this report as well as the relevant secondary literature.

The section on elderly care is based on focus group interviews in Sweden and semi-structured interviews in Finland. Interviewees that participated in the Swedish focus group are working in elderly care provided by a municipality in charge of 900 elderly persons. The focus group comprises one administrative director, an operational manager, a nursing assistant working in home care and one operation developer engaged with e-health. In Finland, the interviewees include a specialist from the Ministry of Social Affairs and Health who acts as the Ministry's co-ordinator in a nationwide "Well-being Artificial Intelligence and Robotics" (Hyteairo) network programme, two officials from the Finnish Union of Practical Nurses, the head of elderly care services of a Finnish city and three experts from a private enterprise that acts as a service provider and distributor of pharmaceuticals and health products in Finland. These four interviews were conducted separately in each organization. The analysis was supplemented by a literature review and an examination of public statistics and policy documents.

The section on the Nordic banking sector is based on semi-structured interviews conducted in Denmark, Finland, Norway and Sweden. These interviews were also supplemented by a literature review and a systematic trawl of the Internet. The Danish data build on six interviews, including two company managers, two trade union officials and two representatives of the employers' association. In Finland, the data stem from interviews with two trade union officials, three representatives of two employers' associations and a group interview conducted with a Finnish bank group comprising managers from the corporate headquarters and individual banks as well as a staff representative. In Norway, interviews were conducted with representatives of the employers, the trade union and human resources/innovation managers in two of the leading banks. In Sweden, interviews were conducted with two representatives of one of the biggest Nordic banks engaged in the development of digital services and three trade union representatives. Due to health problems, one of the union representatives initially answered our questions by mail, which we then followed up by conducting a phone interview.



# About this publication

## Digital Transformations of Traditional Work in the Nordic Countries

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