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CHANGING SKILLS FOR A CHANGING WORLD

Understanding skills demand in EU neighbouring countries

A collection of articles

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Understanding skills demand in EU neighbouring countries

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The contents of this collection of articles are the sole responsibility of the authors and do not necessarily reflect the views of the ETF or the EU institutions.

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Preface

Our world is experiencing a period of profound change, driven by technological advances – notably in terms of digital technologies – alongside the need for greening our economies and societies. Change affects all countries of the world, transforming their economies and labour markets, albeit at different rates. Change also involves uncertainty, opportunities and risks that need to be managed if progress is to be made towards building more inclusive, greener and more prosperous societies. In this context, governments need to ensure that all their citizens are equipped with the skills to adapt to new labour market realities and the capabilities to contribute to economic and social development.

The questions that arise are: What are these skills? How are they changing in line with the current economic and labour market transformations? Skills needs are defined as the specific competences demanded by employers, firms or economic sectors to enable the economy to function effectively. Such needs may arise as a result of quantitative pressures or skills gaps. They can also appear where new sectors or industries emerge, where new technologies are introduced, or where new jobs are created as a result of convergence between existing sectors or industries.

Documenting changes in labour markets and skills demands is crucial for designing better skills development systems to meet future needs. The alternative is skills mismatch, which presents an obstacle to firms' growth and competitiveness, as well as hindering individuals' ability to advance within the labour market. If done well, skills demand analyses predict future imbalances and inform the public about the potential needs of employers. The final aim is to improve the skills match between labour demand and supply in terms of both quantity and quality. To this end, it is vital to have reliable information about the knowledge and skills required for specific jobs and the likely changes in the content of different occupations.

While many studies on the effects of technological and societal changes on skills demand are undertaken in advanced (high-income) economies, there is little information or evidence that relates to developing and transition countries[1]. This was one of the key findings of the ETF conference 'Skills for the Future: Managing Transition', held in November 2018[2]. Since then, the ETF has launched a series of actions through its Skills Lab[3] to enrich the intelligence on changing skills demands in its partner countries, generating new evidence and analysing and disseminating the existing data.

This publication is part of that effort. Its particular focus is on high or low middle-income countries neighbouring the European Union (EU). The papers gathered here comprise 13 independent articles written by researchers and experts from various countries in response to a call for expression of interest that the ETF launched in 2019[4]. The collection is by no means exhaustive of the research taking place in the ETF partner countries.

Each article documents one or more changes in the labour markets and/or skills demands of the countries reviewed, incorporating relevant case studies backed up by qualitative or quantitative research and data analysis. The labour market changes analysed encompass shifts in sectors, job creation and destruction trends, emerging tasks and occupations, new patterns of employment and changing employment relations. As a consequence, emerging demands for new skills (current and future) and occupations are also addressed. The articles apply a range of different methodologies, many of which are experimental. Indeed, the authors base their analyses on information gathered from different sources and through various data collection instruments, the validity of which could not be verified by the ETF. Accordingly, the results of the articles should be seen as a basis for discussion and further research rather than as definitive responses to the issues they address.

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[1] Although different terms and definitions can be used regarding the development phase of countries, for example transition countries, developing countries or emerging economies, this publication primarily focuses on the ETF partner countries (see www.etf.europa.eu/en/regions-and-countries). With the exception of Israel, which has high-income country status, this group comprises low or high middle-income countries.

[2] See Skills for the Future: Managing Transition – conference conclusions: www.etf.europa.eu/en/publications-and-resources/publications/skills-future-conclusions

[3] See www.etf.europa.eu/en/projects/skills-lab

[4] See www.etf.europa.eu/en/news-and-events/news/understanding-skills-demand-changing-world

Publication structure

This publication is divided into three parts. **Part 1** consists of two editorial articles written by the ETF as an introduction to the debate. They present an overview of global and regional trends.

- Article 1 reviews existing studies on the future of work and skills at the global level and summarises seven broad trends shaping labour markets and demand for labour, using evidence taken mostly from advanced economies. Although similar general trends can be detected everywhere, the nature and extent of their development vary from country to country. Thus, this article also discusses the main factors that may explain the appearance of different influences across various countries, and includes a section on demands for skills that run counter to the general flow of change.
- Article 2 focuses on region-specific transformations observed in the European neighbourhood countries, which are mostly high or low middle-income countries. It presents a systematic review of the recent economic and labour market trends in the ETF partner countries, and provides a background analysis for the articles that follow.

Part 2 groups together six articles covering changes in occupations, sectors and employment patterns across a range of countries.

- Article 3 attempts to quantify the risk of automation faced by workers in the urban areas of Armenia, Georgia, Moldova and North Macedonia, estimating the proportion of jobs at high, medium and low risk of automation. The results provide evidence for job polarisation and automation as well as the need for upskilling and reskilling – more so in Moldova and North Macedonia than in Georgia and Armenia.
- Article 4 goes on to forecast sectoral and occupational labour demand in North Macedonia for 2030. Results suggest a shift in employment towards occupations and sectors requiring medium- and high-level skills, a trend which is likely to aggravate the current skills shortages.
- Article 5 identifies the jobs that are most 'at risk' of automation through task- and skills-based analysis at the regional level, focusing on Istanbul and North Macedonia. These results are complemented by the identification of a number of possible 'safe' jobs for those at risk, focusing on certain occupations where the transition process could be relatively easy.
- Article 6 looks at the main determinants of labour demand in the growing ICT services sector across different income country groups, highlighting the case of Israel in particular. The analysis confirms a positive contribution of ICT service exports to employment in the ICT service sector, with beneficial effects noted especially for the presence of women in the workforce.
- Article 7 analyses the socio-economic position and status of digital workers on global platforms from the perspective of 'decent work' in Serbia. The study confirms that most Serbian digital workers are highly educated individuals commanding decent wages, but that their employment status is far from clear.
- Article 8 looks at the working conditions of drivers for Car:Go – a Serbian platform-based ride-hailing service with a unique business model – and finds similarities with other global platform workers.

Part 3 of the publication gathers together a further five articles covering changing demand in different skills sets and qualifications across several neighbouring countries.

- Article 9 starts by looking at the incidence of skills mismatch in a number of countries (Serbia, Montenegro, North Macedonia, Moldova, Georgia, Egypt and Morocco) in the context of changing dynamics within economies and societies, notably, for example, sectoral shifts, occupational changes, demographic movements, education-related factors and individual preferences. Despite the complexity of the data collection and measurement process, the results show a high incidence of skills mismatch in transition countries.
- Article 10 explores the changes in both job content and education and skills demands for entry-level jobs in the retail banking sector in Lebanon. Through interviews with both employers and employees, the author documents the move towards raising the skills sets and education levels required to work in this sector, and highlights the recruitment strategies devised to achieve this.
- Article 11 uses non-traditional web data and analyses the online job vacancies published in a particular portal in North Macedonia. The results show that 'professionals' are the most requested type of employee among all occupational groups, followed by 'service and sales workers' and 'technicians and associate professionals'. A comparison of web-based results with more traditional survey-based data points to significant discrepancies in demand for the same occupational groups – a finding that could be explained by a variety of factors.

- Article 12 uncovers the skills needed to implement smart specialisation strategies and the extent to which the existing evidence in the renewable energy sector in Moldova and health tourism in Montenegro can provide answers. The approach assesses the skills implications of economic prioritisation resulting from smart specialisation and seeks to find ways to connect vocational education and skills provision to the broader drive for innovation. The article argues for the need to integrate vocational education skills analysis within the smart specialisation approach, as all sectors need both high and medium-level technical skills.
- Article 13 analyses the extent and nature of digital skills gaps and mismatch in the labour markets of the Western Balkans. It provides evidence of a general shortage of job applicants with ICT qualifications, combined with an oversupply of graduates from other fields of study. Without a change in the policies related to the provision of higher education, this skills gap is likely to persist into the future.

The ETF hopes that the findings presented here will inspire further discussion and research to help those working in the fields of skills assessment and skills development processes to meet the needs of tomorrow's labour markets, economies and societies. Armed with such knowledge, individuals and companies can take well-informed decisions, while at the same time, grounded in empirical evidence, education and training policy can be reshaped to take future trends into account. Drawing out the implications of skills demand analysis for policy and practice can be a challenge, yet this process is at the heart of reforming national education and training systems, as well as developing and updating occupational and qualification standards and definitions, employment strategies, active labour market programmes and migration policy. Achieving success in these areas depends on creating a shared path and goals to improve human resources and respond to future skills needs, while at the same time reconciling the interests of a number of different parties (companies, workers and public institutions, among others).

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PART 1

INTRODUCTION TO THE FUTURE OF WORK AND SKILLS

ARTICLE 1
GLOBAL TRENDS SHAPING LABOUR MARKETS AND THE DEMAND FOR LABOUR IN THE WORLD: AN OVERVIEW

Ummuhan Bardak, with contributions from Anastasia Fetsi and Francesca Rosso

1.1 A time of disruptive change

Today we are witnessing a host of global forces at work disrupting past trends and hitting and transforming global markets, economies and societies. For instance, we face accelerating technological advances and digitisation, increased global connections (e.g. trade, finance, people and data), climate change, and demographic ageing, declining or growing populations. Compared with the Industrial Revolution, some experts estimate that current changes are happening at a rate that is 10 times faster and at a scale that is 300 times greater, that is, they are having roughly 3 000 times the impact (Dobbs et al., 2015). Meanwhile, climate and other environmental changes risk the destruction of nature and the disruption of economic production processes, while the recent health crisis of Covid-19 has suddenly upended lives at global level. Yet we are far from grasping the full magnitude or the second- and third-order effects of all these disruptions on our economies. Some forces amplify one another, while others weaken the changes as they interact. Together, however, they are giving rise to monumental changes that deeply affect the economic, social and political landscape, and all of them pose major risks and opportunities for inclusive, innovative and greener societies.

Based on a comprehensive review of the existing literature, this article seeks to present an overview of the global trends that ultimately affect labour markets and skills needs in all countries. The article starts with a brief introduction of the most important disruptive changes identified so far. Then Section 1.2 focuses on the specific trends shaping labour markets and the demand for labour, drawing seven broad trends from the literature. These trends lie at the core of the article. Next comes Section 1.3, which deals with the varying impact across countries and sets out to explain the main factors that influence this variation. Given the identified trends that are shaping labour markets, Section 1.4 goes on to discuss the changes observed in the skills needs of economies and enterprises. Finally,

Section 1.5 seeks to draw some policy conclusions based on the article's findings.

The single most important disruption comes from technology. From the printing press to the steam engine and the internet, technological change has always been a major force in overturning the status quo. The difference today lies in the exponential growth and pervasive diffusion of technology in our lives as well as the speed of change itself. While it took the radio 38 years to attract 50 million listeners, Facebook attracted 6 million users in its first year and user numbers multiplied 100 times in five years[1]. As of January 2020, nearly 60% of the world's population was already online, amounting to more than 4.54 billion internet users, while social media users surpassed 3.8 billion[2]. Globally, more than 5.19 billion people used mobile phones and 1 million people went online for the first time on every single day of 2019. According to the *Digital 2020 Global Digital Overview* report, we spent more than 40% of our waking lives in 2019 using the internet (that is, more than 100 days online). This is a modest estimate of internet use made before the Covid-19 pandemic erupted in February 2020.

Mobile internet, connectivity, cloud computing and processing power are only part of the story. Their impact is multiplied by the concomitant data revolution, which creates unprecedented amounts of information, together with the proliferation of technology-based business models, which range from online retail platforms like Amazon to car-hailing apps like Uber to digital payment systems. This process has made it possible to collate and organise information and data in ways that were unthinkable in the past. Big Data is called 'the new oil' as a growing mass of exponential data is generated every day across the globe as a result of the increasing digitisation of processes, services,

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[1]   See Digital, Social & Mobile in 2015, http://wearesocial.sg/blog/2015/01/digital-social-mobile-2015/

[2]   See Digital 2020 Global Digital Overview, https://wearesocial.com/uk/blog/2020/01/digital-2020-3-8-billion-people-use-social-media

business, and personal and social interactions[3]. Accelerated adoption leads to accelerated innovation: from the Internet of Things (IoT) and the Internet of Services (IoS) to robotics, advanced manufacturing and 3D printing, autonomous vehicles, and artificial intelligence (AI). With further advances in nanotechnology, biotechnology, materials science and other areas, some have even started to talk about the possibility of our physical, biological and digital worlds converging in the future.

New technologies have vastly reduced the transaction costs of production, communication and coordination on a global scale, leading to a deeper integration of all production factors (capital, labour and raw materials) (ETF, 2019a). World trade, investment and production are now increasingly organised around global value chains, which extend from design, production, marketing, logistics and distribution to support for the final customer. During the first wave of globalisation in the early 1970s, corporate value chains were limited to low-skilled, low-paid work, while most high value-added activities remained close to head office. The second wave, however, set off a step-change in scale and scope, as multinational companies moved some high value-added production to regional value chains. This led to a convergence between the high-quality production of advanced economies and the low-cost production of emerging economies, so that the distinction between 'head nations' (characterised by high-skilled, high-wage jobs) and 'body nations' (with low-skilled, low-wage jobs) has become blurred (Brown et al., 2015). Through new technologies that enable fragmentation and specialisation at all levels of tasks, business functions and production, some emerging economies have leapfrogged decades of incremental changes in technologies and business practices[4].

The third wave of the revolution in global value chains was made possible by the continuous stratification and standardisation of knowledge work (OECD, 2017). Knowledge is now captured and codified through digital software, 'translating knowledge work into working knowledge and standardising many technical and professional jobs' for outsourcing (Brown et al., 2011). The shift from national to international skills networks has enabled today's transnational companies to use 'white collar offshoring' in many areas of knowledge work. Lead firms can increasingly draw on knowledge, resources and a production factor base that are international as opposed to domestic, while small firms can gradually take part in global activities without first having to master all the technological and managerial knowledge. The result has been a growth in international trade, especially in intermediate inputs, through integration into global value chains and a significant offshoring from developed to developing regions, which is sometimes called 'de-industrialisation'. Nor are global value chains limited to manufacturing, but also apply to agriculture and services. Indeed, cross-border services are growing 60% faster than the trade in goods (McKinsey, 2019)[5].

These changes have transformed the functioning of economies. An increasing shift towards service jobs is observed, both in high-end, knowledge-intensive and in low-end, low-skilled services. Many countries have experienced regional shifts in their employment structure and an increase in regional disparities, with capital city regions gaining the greatest benefit from the services shift and globalisation megatrends. This is explained by a host of reasons: better infrastructure (including digital infrastructure); easy access to services; a concentration of human capital, which is also linked to the availability of educational and research institutions; the existence of economic clusters; and an accumulation of wealth and potential customers to buy services. For example, the capital cities in EU-28 Member States account for a disproportionate share of the newly created well-paid jobs (Eurofound, 2019c). In the UK, for instance, periphery regions have seen a decline in dangerous, dirty, boring or unrewarding jobs, but this has been outweighed by the mostly

[3] There are increasing criticisms about this data revolution and the storage of vast amounts of personal data through apps, platforms and smart objects. Couldry and Mejias (2019) call this 'data colonialism' that is designed to capture and translate our lives into data, and extract information to change our behaviour and control our lives (our ways of knowing, means of production and political participation).

[4] Almost all Western models of economic development are typically based on stage theory. It has been assumed that countries move steadily from one stage of development to another – from agriculture to manufacturing to services. According to Brown et al., the reality is different as emerging economies have leapfrogged to the technologies and business practices applied by advanced economies. Rapid advances in mobile and internet communications, knowledge diffusion, and the benchmarking of global quality standards have contributed to a process of disruptive innovation. In this new stage, competition is no longer based on selecting either quality or cost. All companies and countries need to take into

account both quality and cost if they are to be competitive (Brown et al., 2015).

[5] In 2018, the total volume of global cross-border trade in services was valued at USD 5.8 trillion, a quarter of the value of total exports and 7% of world GDP. From 2005 to the third quarter of 2019, global trade in services increased by 20%, but the Covid-19 crisis has further accelerated the growth of global trade in services, including the share of the digital gig economy.

higher-skilled jobs that have been created primarily in London and the Southeast (Deloitte, 2015). These new jobs are often in the services sector, especially creative, caring and complex occupations such as care workers and chefs, and in the financial services sector. Collectively, they have added a net GBP 140 billion in value to the economy through higher wages (ibid).

In addition, the digital economy has introduced many novelties into the operation of firms. For example, the costs of production and distribution are no longer linked to the volumes produced but must be paid when the initial investment is made, that is, there are zero or quasi-zero marginal costs. Since software is a layer built on a foundation of computing, digital products can be replicated at almost no marginal cost (e.g. e-books)[6]. Alternatively, the value of a digital good or service will increase as a function of network size (without any attendant increase in costs), e.g. greater returns owing to positive network externalities (Eurofound, 2018a). The result is the emergence of a new business model known as 'two-sided markets': one side of the market is made up of consumers who benefit from access to low-cost or free services, while the other side comprises economic players that are involved in the provision of platform-based services[7]. The information collected through the use of a service creates extra value. This business model has also changed the rules of competition in the sectors where platforms operate. In a nutshell, 'the winner takes all'. The digital goods and services that sign up the highest number of subscribing users are the absolute winners (Drahokoupil and Fabo, 2016).

Last but not least, environmental challenges – global warming, hurricanes, flooding, extreme droughts, rising sea levels, the reduction of biodiversity – force policymakers to take action in pursuit of the greening of economies. With the United Nations (UN) Agenda for Sustainable Development and the Paris Climate Agreement, the pressure has been growing for green policies and regulations, green

technology and innovation, and green producers and consumers, but there are difficulties too. The transformation to a green economy oriented towards sustainable development will require the reshaping of all systems of production, distribution and consumption. According to the ILO (Strietska-Ilina et al., 2011), the greening of economies will entail shifting activities from those that are less energy-efficient and generate higher CO_2 emissions towards those that are more efficient and less polluting (known as 'green restructuring'). These activities vary from protecting and restoring ecosystems and biodiversity to reducing the consumption of energy and raw materials, decarbonising the economy and minimising the production of waste and pollution. Examples can be found in any economic sector, including the environmental goods and services sector, construction, agriculture, transportation, manufacturing and recycling.

1.2 Trends shaping labour markets and the demand for labour

The world of work is changing in several ways as a result of technological advances and digitisation acting in combination with other drivers of change, such as greater global connections, ageing versus exploding populations or climate change. Perhaps the most visible effect in economies can be seen in how work is organised and performed. The changes in jobs relate to the content, the working methods and the tools used in the workplace[8]. As a knock-on effect, job changes lead to changes in employment, i.e. the terms and conditions under which a job is undertaken for an employer and typically made explicit in a contract (JRC, 2019b)[9]. Consequently, the direction of the transformation in labour markets and the new demand for labour has become a significant research topic among experts. A review of the existing literature points to several trends (or phenomena) that characterise evolving labour markets and consequently shape the demand for labour.

The first trend is the destruction of some jobs owing to automation. The risk of automation has been studied by many scholars, but there is a wide

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[6] This is why a phenomenon like Pokémon GO was able to draw 50 million users in just 19 days. One can only imagine this kind of scalability when applied to things like artificial intelligence or virtual reality.

[7] Some economists use the concept of 'prosumers' for consumers in the digital economy, i.e. individuals who both produce and consume digitised information (Drahokoupil and Fabo, 2016). The JRC (2019b) describes it as the 'harvesting of information by [platform] companies from individuals generated in both production and consumption', which these companies then commercialise but without sharing the financial benefits with the individuals who generated the information and data. Even though the surplus value is co-created, it is captured solely by the company.

[8] For the purposes of this article, work is defined as an activity performed by people to produce goods and services with exchange value for their own or others' use. On the other hand, a job is a position of paid employment consisting of duties, responsibilities and tasks to perform.

[9] Standard employment is often articulated as a permanent, full-time, single-employer job, which is regarded as a 'good job'.

variation in their results for the same countries. For example, Frey and Osborne (2017) predicted that up to 47% of all US jobs were at high risk of being automated, and the application of the same calculation gave a similar high risk of 54% in the EU. On the other hand, Arntz et al. (2016) used another method of calculation and found that only 9% of jobs were at high risk of being automated in OECD countries. Another study by Nedelkoska and Quintini (2018) found 14% of jobs at high risk of automation in OECD countries. These results are quite contradictory and the time scales for change are often vague or unspecified. Different results found for the same countries are explained by the use of different methodologies (e.g. complementarity, substitution or task-based models). In the occupation-based model, technology can complement some workers (skills-biased), but also substitute others (labour-saving), while the task-based model points to a shifting of job content towards more intellectual tasks (Eurofound, 2018c).

What matters is whether a task is routine or non-routine. There is broad agreement in the literature that routine tasks, both cognitive and manual ones, are increasingly becoming automated, making some medium-level occupations redundant (bookkeepers, cashiers, clerical occupations, etc.). Another example is the advent of online and mobile banking and the growth in cash-free payments through digital interfaces in the banking sector, which have led to automated services such as robotic process automation systems, chatbots and virtual assistants[10]. Thus, work is becoming more intensive in non-routine tasks and routine ones are being automated (Eurofound, 2020). The risk of automation differs significantly across sectors, occupations and regions, but it has been particularly high in medium-skilled occupations. Subsequently, however, it has also spread to some low-skilled tasks, and even some tasks in high-skilled occupations cannot escape from it owing to recent developments in artificial intelligence (JRC, 2019a).

The second trend relates to the changing task content of existing occupations, leading to the revision or redefinition of the tasks required to perform those occupations[11]. The impact of energy-saving technologies on construction sector jobs is a case in point, as is the widespread uptake of digital technologies that are changing the working methods and tools used in jobs. The adoption of new technologies goes hand in hand with a new division of labour in which workers increasingly perform tasks that complement or oversee machines. Some studies suggest that reskilling is a constant process within occupations and that the holders of such occupations might be able to tackle occupational changes. Eurofound research (2020) highlights the upgrading of jobs in manufacturing, where there is a likely shift towards monitoring and machine-control tasks, often requiring workers to upskill. In services, the task content of jobs is also evolving; for example, the job content of a bank teller position has changed from clerical skills to customer service and sales skills. In finance, the use of financial algorithms has changed the way brokers operate, resulting in a greater reliance on computers and a reduction in the amount of time spent dealing directly with other people.

The tasks framework developed for occupations by Eurofound (2018b) breaks down tasks by (i) their content, and (ii) the methods and tools used to perform them. The task content could be physical (strength, dexterity); intellectual (literacy, numeracy, problem-solving); or social (serving, teaching, selling, managing). The methods of work are related to the degree of autonomy, teamwork and routine (repetitiveness, standardisation), while the tools are machines and information and communication technologies (basic ICT, programming). A task analysis of occupations in EU-28 Member States has indicated that structural changes are leading to a gradual decline in physical tasks (both those requiring physical strength and dexterity) and routine tasks (repetitiveness) (Eurofound, 2018c). On the other hand, intellectual and social tasks are increasing across the board in all sub-categories. Particularly notable is the growth of numerical tasks and business literacy in the intellectual category and the growth of selling/persuading and serving/attending in the social category. Autonomy is increasing as a new method of work, while ICT tasks show the highest increase across all occupations (Eurofound, 2018c). The rise in intellectual tasks has raised the prominence of STEM occupations (science and engineering professionals and associate professionals). From 2003 to 2013, their employment share in EU-28 Member States rose by 12%, three times higher than total job growth (European Commission, 2015a). In 2015 they accounted for 7% of all jobs in the EU, and they are expected to grow to 20% by 2025.

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[10] Richard Baldwin calls these tasks 'white collar robots', see https://voxeu.org/article/covid-hysteresis-and-future-work

[11] Occupations are defined as a job or grouping of jobs involving similar content in terms of tasks and which require similar types of skills and competences. In common use, the term 'profession' refers to a specific kind of occupation, one that distinguishes itself through a supposedly higher degree of specialisation, professional training and professional identity.

The shift towards upgraded jobs and higher educated workers has long been explained in the literature by the hypothesis of skills-biased technological change (Acemoglu and Autor, 2011). The shift from unskilled to skilled jobs was noted as early as the 1980s and seen largely as an international phenomenon that had increased the relative demand for skilled workers everywhere. The adoption of machines was associated with reduced labour input of routine manual and cognitive tasks as well as increased labour input of non-routine cognitive tasks (Eurofound, 2018b; 2018c). These task shifts were then translated into a greater demand for higher educated and skilled workers, a prevalence of machine-skill complementarities, and higher wage returns. As a result, the share of high-skilled occupations in advanced economies has gradually increased by upgrading existing jobs, resulting in 'an augmentation of human intelligence from brawn to brains' (Deloitte, 2015). While technology leads to high-paid jobs that require skills to complement it, it also causes a further decline in the wages for low-skilled workers. This leads to an increase in the share of capital income relative to that of human labour, as the extra wealth created is not shared equally across countries (Martens and Tolan, 2018)[12].

The third trend is a polarising occupational structure, or 'job polarisation'. Job polarisation refers to the declining share of medium-skilled jobs as opposed to increasing shares of higher- and lower-skilled jobs (known as the 'hollowing-out' phenomenon). This is due both to automation (affecting most routine jobs situated in the middle of the skills distribution) and to the offshoring of often medium-skilled jobs mostly in manufacturing (because of globalisation). According to the OECD (2020), the share of medium-skilled jobs fell by almost 12 percentage points in the advanced economies of OECD countries between the mid-1990s and the mid-2010s[13]. These jobs typically employed medium-skilled men (two-thirds) without a tertiary degree, most of them working in manufacturing as drivers, building finishers and machinery mechanics and repairers, but they also included women working as secretaries, cashiers, and bookkeepers and clerks. In addition

to manufacturing, the men worked in construction, transport and storage, while the women were also employed in wholesale and retail trade and public administration. Over the same period, the share of high-skilled jobs rose by almost 9 percentage points and low-skilled jobs climbed by 3 percentage points. Low-skilled service jobs like janitors, household aides and retail sales workers grew at an unprecedented pace, as did high-skilled jobs such as professionals and managers (OECD, 2020).

In the same vein, Cedefop and Eurofound (2018) have forecasted increased polarisation in the future occupational employment structure of the EU-28. Specifically, they have found that the share of medium-skilled occupations will fall from 51 % in 2011 to 46 % in 2030, while the share of high-skilled occupations will rise from 39 % to 43 % and the share of low-skilled occupations will climb from 10 % to 11 % over the same period. Roughly four in five new job openings will relate to high-skilled occupations. Significant employment growth is predicted in the occupations of managers, professionals and associate professionals, together with some growth in less skilled jobs related to occupations in sales, security, cleaning, catering and caring[14]. Job losses are projected in medium-skilled occupations, such as skilled manual workers (especially in agriculture) and clerks (Cedefop and Eurofound, 2018). These developments contribute to rising inequality: despite similar positive trends in the labour demand for both high- and low-paying jobs, there are diverging trends in their respective job quality. Job polarisation translates into wage polarisation and a polarisation in working conditions (Martens and Tolan, 2018). Today, medium-skilled workers are more likely to work in low-skilled occupations with less job stability and lower wages, so that fewer workers (without a tertiary degree) hold relatively good jobs (OECD, 2020).

The fourth trend is the emergence of new jobs. Beyond the evolution of existing jobs, these new jobs are mainly linked to new areas of activity created by the application of new technologies. We see a rapid rise in new kinds of digital jobs such as vlogger, blogger, social media manager, podcast producer, influencer, search engine optimisation specialist, app developer and ethics officer. One

[12]   Some experts also call the phenomenon 'capital-biased' change, given that the labour share of national income has decreased globally. In the last century, the labour share of national incomes fell by 5 percentage points in OECD economies.

[13]   In a study by the OECD (2020), a medium-skilled worker is defined as one who is employed in the ISCO occupational group 4, 7 or 8 and typically holds a secondary education degree along with some further schooling.

[14]   This article does not touch upon the gender implications of job polarisation, which obviously has a strong impact on gender distribution of workers. For example, women constitute the majority of workers in low-skilled service jobs in cleaning, care work, sales and catering (further accentuated during the Covid-19 crisis).

often-cited job profile is for data professionals engaged in the management and elaboration of large amounts of internet data, and new jobs of this kind are called big data specialist, database manager, data scientist or data analyst[15] (Eurofound, 2018d). Other examples are related to more specialised, sub-fields of computer science that did not exist before: cloud computing, robotics, cognitive computing engineer, virtualisation, internet of things architect, block chain developer, algorithm developer, AI specialist, data warehousing specialist and digital satellite system expert. Additional new fields include drone specialist (e.g. unmanned aerial vehicles, docking and charge stations), image analyst, aerial engineer, atmospheric and space scientist, sensors/remote sensing engineer and driverless car engineer. Some of these combine different disciplines into a single job that has multi-disciplinary tasks, e.g. computer science combined with medicine or agriculture. Examples include bioinformatics scientist, biostatistician, biochemical engineer, nanosystem engineer, solar energy system and industrial ecologist. Since these profiles are still in continuous evolution, however, some experts do not see them as new jobs but rather as revised or upgraded occupations (Eurofound, 2018b; 2018d).

A fifth trend relates to the stratification or segmentation of knowledge work, or what has been called 'digital Taylorism'. According to Brown et al. (2011), the application of new technologies to white-collar work is a new trend. The translation of knowledge work into working knowledge, captured through digital software, is reminiscent of the rise of mechanical Taylorism and mass production in the early 20th century. The separation between 'conception' (thinking) and 'execution' (doing) that characterised Taylorism and its Fordist production line are applied to knowledge work in the 21st century digital economy. The same processes that enabled cars or computers to be broken down into their component parts are now being applied in the service sector to impersonal jobs, that is, jobs that do not depend on face-to-face interactions with customers. This is a stratification or segmentation of knowledge, which restricts permission to think to people in 'developer roles', typically including executive staff and high potential researchers and professionals recruited from global elite universities. Developer roles are distinct from 'demonstrator roles', which employ people to implement or execute existing knowledge, procedures or

managerial protocols. The result is an increasing standardisation of many technical, managerial and professional jobs, which breaks the human capital bargain based on the idea that 'learning equals earning' (Brown et al., 2011; 2015)[16].

The sixth trend lies in the changes occurring to employment patterns. Non-standard forms of employment (atypical jobs) are expanding and increasing, from temporary (fixed-term) workers and temporary agency and contract company workers to own-account self-employed workers, freelancers, part-timers, independent contractors, on-call or on-demand workers[17], and more recently just-in-time labour[18] or gig[19] workers. With globalisation, the increasing mix and diversification of work arrangements have long been on the rise. However, the evolution of employment has accelerated with the emergence of new business models in the digital economy (e.g. crowdworking[20] and work-on-demand in the gig economy). For example, short-term work contracts of one year or less have become increasingly common owing to the outsourcing of jobs and the fragmentation of work tasks[21]. A significant shift towards part-time and temporary employment has been observed in Europe over the past three decades (European Parliament, 2019). In 2018, the share of part-time workers was almost 20% of total employment in the EU, while the share of temporary workers was 13% and the proportion of self-employed workers was 14% (with the highest increase occurring in own-account workers) (JRC, 2019a; European Parliament, 2019). Employment practices are also changing even in standard jobs (i.e. permanent, full-time, single-employer jobs), including increased

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16   Thus, new technologies are not always 'skills-biased'. Some experts view the shift more positively as a liberation of professions, breaking the monopoly of professional practices as expert knowledge becomes more widely accessible through new modes of digital communication (Susskind and Susskind, 2015).

17   On-demand work uses a project approach, so that teams are disbanded when their assignment has been completed.

18   Just-in-time labour involves a shift from jobs to tasks and services, and from employees to independent contractors.

19   The basic model of 'labour on demand' has come to be called the gig economy because unlike jobs, which imply an ongoing and perhaps indefinite connection between employer and employee, gig labourers perform a particular service for a fee.

20   In crowdworking, a client/employer posts micro-tasks on an internet platform and selects from a virtual pool of workers.

21   The outsourcing of jobs has blurred the line between dependent employment and self-employment. As a result, for example, we have the so-called 'economically dependent', self-employed workers who are own-account workers that have one client from whom they earn at least 50% of their total income (JRC, 2019a).

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15   This profile combines aspects from the profiles of a mathematician, computer scientist, trend-spotter and explorer of interactions between the business and IT worlds.

multi-disciplinary teamwork in projects, flexitime and teleworking arrangements, particularly during the Covid-19 pandemic.

Diverse work forms have exploded with the emergence of the platform economy and the migration of work to platforms. Platforms are digital networks that coordinate economic transactions, usually matching the demand for and supply of resources quickly and efficiently through algorithms and providing more transparency and availability while also reducing transaction costs (Eurofound, 2018a)[22]. Owing to the increased standardisation of work via technology, platforms reduce the monitoring and supervisory costs of work and enable remote monitoring. They allow for better coordination of workers across space and time, enabling increased reliance on flexible and non-standard work and expanding the possibilities of just-in-time labour. Now workers and employers make short-term contracts rather than agreeing to anything resembling a stable job, shifting employment from a career/job to a task. Some call this shift 'the death of employment' as jobs are replaced by contracts for gig workers who undertake micro tasks (JRC, 2019b). The use of platforms for the delivery of goods and services is the most highly visible form (Uber is the poster child). With platforms and smartphones, many personal services that are relatively immune to automation and offshoring are now subject to 'Uberisation': being hired and paid by the task. There is now some kind of Uber for many personal services, such as deliveries, on-street valet parking, physician house calls and diaper changing.

Platform workers are heterogeneous, but they can be broadly divided into two groups: on-demand work and crowdwork (Drahokoupil and Jepsen, 2017). With on-demand work, the matching of supply and demand takes place over a platform, but the service itself is delivered in a real, geographically defined space (e.g. Uber). With crowdwork, the entire process takes place online and the work is

done remotely. The latter is sometimes divided into microwork (e.g. Amazon Mechanical Turk and Crowdflower) and online freelancing (e.g. Upwork and Freelancer). Platform work opens up many opportunities for people with high skills, given that technology can be used to create and capture value. It is one of the reasons for the rapid growth in high-skilled solo entrepreneurs or freelance professionals. It creates jobs without borders, matching labour demand and supply virtually across the globe without the need for physical migration or mobility. That is, it gives access to skills, knowledge and know-how without boundaries. As the recent Covid-19 pandemic has shown, more firms see international teleworking as feasible owing to lower costs (financial and time costs), greater flexibility, and access to a global pool of skills[23]. The extent of platform work is still limited, but it is increasing quickly. Given its cross-sectoral nature and continuous evolution, it is difficult to capture: 2% of the EU workforce works on platforms and up to 11% has performed platform work at least once (European Commission, 2019b).

The seventh and related trend concerns the erosion of standard employment benefits. The changes in employment patterns explained above have reduced the share of good jobs out of total employment, i.e. permanent, full-time employment, and diminished most employment-related benefits. Many studies point to non-standard forms of employment to account for the shrinking employment benefits of workers (Kautonen et al., 2010). Atypical jobs typically have higher job and income insecurity, greater unpredictability, more unilateral flexibility imposed on workers, lower wages, increased casualisation and disguising of work, unusually long or short work hours, and little or no social security (ILO, 2018). By working anytime and anywhere, they have blurred the lines between private and working life under the pretext of work-life balance, eroded the traditional employer-employee relationship and increased the share of self-employment, leading to a lack of clarity on employment status and regulatory loopholes (Drahokoupil and Fabo, 2016). As own-account workers (a form of self-employment), these workers are now in charge of their own destiny from working hours to social insurance and training, because they no longer have a single employer.

In particular, platform work has raised concerns about amplifying or reproducing broader trends

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[22] Platforms differ: some focus on the exchange of goods or services, while others are driven by 'requesters' who can be companies or individuals and still others are driven by workers offering goods and services. However, most are open to all workers in order to generate network effects, drive platform expansion and reduce competition (Eurofound, 2018a). Eurofound (2019a) classifies platforms based on a number of factors: platform ownership (private or commonly owned by the users); the economic nature of transactions (commercial or non-commercial)l and the content of transactions (platforms to exchange goods, such as eBay and Amazon, or platforms to exchange services, such as Uber and Airbnb). There are additional criteria to define platforms for the exchange of services: online vs. local, and types of tasks provided (physical, intellectual, social).

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[23] Richard Baldwin calls this phenomenon 'telemigration', see https://voxeu.org/article/covid-hysteresis-and-future-work

of employment precarity (e.g. uncertainty, volatility and insecurity). In theory, platform work provides greater flexibility and autonomy for workers by taking an intermediary employer out of the equation, but critics emphasise the platform companies' control over workers and the ambiguity over these workers' employment status. With service providers labelled as 'independent contractors', platform companies offload risks and costs by accessing a flexible, scalable workforce, while simultaneously bypassing the traditional or national boundaries of labour laws and regulations; however, they still shape the terms of employment and exercise soft control over their workforce (JRC, 2019b). For a thorough analysis, more data are needed[24], but the most important effect of platforms on labour lies in the shift from traditional employment relations to self-employment activities (Drahokoupil and Jepsen, 2017). In this precarious, involuntary form of self-employment, the person loses the benefits of both regular employment and self-employment: even basic job benefits are gone; the worker has no paid leave of any kind, no social insurance of any kind, limited opportunities for professional development or career progression, etc. (Kautonen et al., 2010).

Having interviewed hundreds of on-demand gig workers in the US and India, Gary and Suri call them 'ghost workers, disposable people who work behind the curtain to ensure the internet lives up to its promise'. These workers spend far more hours searching for quick gigs than actually performing them, and their jobs last for seconds, not years. They are all homeworkers, they do not get offices, uniforms, computers, software, training, supervision, encouragement or praise. There are no bonuses, vacations, promotions or awards. They sit in front of their own screens, madly searching for mini-gigs that pay a cent or two, and must be completed in seconds. They are nameless. Despite the divide-and-conquer nature of everyone working on their own, they have still found ways to communicate, link up and share knowledge of new gigs that people working in isolation might not see. (Gary and Suri, 2019).

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[24]   The irony is that because platform companies digitise the processing and storage of often real-time information, good data exist on the nature of both work and employment. However, the data are held privately by the platform companies and, because they can be a commercialised asset, they are unlikely to be made publicly available. If Industry 4.0 becomes more pervasive, similar data are likely to emerge in relation to the digitisation of production and workers (i.e. microchips) but will again be a private rather than a public good.

1.3 Are these trends the same in every country?

The section above summarises the existing literature in terms of seven broad trends that are shaping labour markets and the demand for labour. However, it must be highlighted that: (i) almost all of this information comes from research and evidence from advanced economies and very little comes from developing countries; (ii) the literature is full of vague references to how long it will actually take for workplaces, jobs and skills to be transformed; (iii) some of the research could not avoid the trap of technological determinism; and (iv) the results of the same methodological analyses are hugely different from one sector to another, from one country to another. Although the global transformations in question affect every country, their impacts vary across countries. That is, the seven trends identified in Section 1.2 are seen everywhere, but the course and extent of their development (the pattern of trends) differ from country to country. In order to understand the potential futures of countries, this section seeks to identify the main factors that may explain the differing trends and how the factors interact with one another.

In technology-related discussions, the idea of a deterministic future is difficult to resist. Much of the current debate centres on the potential of technology rather than its empirical realisation on the ground. Indeed, the empirical evidence on what is actually happening in firms is limited. The likely effects of technologies on countries are not predictable or inevitable, since their adoption in any given country depends on its institutional and regulatory context, political choices, the business environment and company structures, the level of human capital, and the public's interest in and acceptance of new technology. As a result, multiple possible futures exist. A specific job can be performed in many different ways, depending on how work is organised and technologies are used in production (Nedelkoska and Quintini, 2018). Sales workers, for example, are often cited as facing a high probability of automation, but customers consistently prefer face-to-face social interactions over machines. The airline pilot is another example of consumers preferring humans to machines: the technology is ready, but the public is not prepared for pilotless aircraft. Just because something can be automated in theory does not mean that it will be economically or politically viable in practice.

The studies on jobs at risk of automation illustrate well the need for caution. In addition to different methodologies resulting in different outcomes for the same country (Section 1.2), the same calculation method can also yield hugely diverse

results from country to country. Arntz et al. (2016) have estimated the share of jobs at high risk of automation at 6% in Korea and 12% in Germany and Austria. Nedelkoska and Quintini (2018) have found this share of jobs to be 6% in Norway and 33% in Slovakia. Lordan's (2018) estimations of jobs that are fully automatable in the next decade range from 69% in Czechia, 66% in Germany and 58% in Italy to 43% in the UK and 37% in Norway and Ireland. This is because the models in their studies incorporate economic and social factors that stimulate or deter the replacement of workers by technology. Given that technology cannot be disentangled from other socio-economic processes with which it interacts, such factors play an important role in shaping whether and how technological change takes place in each country and what the consequences, if any, will be.

Country variations in the patterns of the seven identified trends are driven by a complex set of factors: the political and economic structure, the legal and institutional system, political leadership, the business environment and industrial relations, innovation capacity, technological adoption, human resources, the structure and age of the workforce, labour costs, workers' involvement in strategic decisions, etc. As a starting point, the economic structure is key to the wealth of countries; it covers the total of invested capital, outputs, trade, incomes and employment for all the various economic sectors, which range from primary (farming, fishing, mining, etc.) to secondary (manufacturing and construction industries) to tertiary and quaternary (tourism, banking and software industries) sectors. It also determines the prosperity of local populations, the employment structure and the competitiveness of sectors. In turn, the competitiveness of sectors is shaped by institutions, infrastructure, macroeconomic environment, market size and efficiency, financial and labour markets, business sophistication and innovation.

A difference in industrial structures is often cited as one of the main reasons for different trends in automation. For example, countries with a larger share of jobs in manufacturing will show a higher average susceptibility to automation, especially in office administration, production, transportation and food preparation (Muro et al., 2019). Another factor is the degree of sophistication in production, which leads to a different occupational composition in sectors (and different employment shares of occupations). The Joint Research Centre has observed that in France less than 50% of non-managerial, professional and technical occupations in the textile and leather sector could potentially be lost by 2030, whereas the figure for Poland is close to 78%. In the automotive sector, only 30% of jobs

in France could be lost compared to 84% in Poland (JRC, 2019b).

The innovation capacity of a country is crucial to improving productivity and prosperity. Innovation capacity relates to the ability to create and commercialise new products and processes, and it is affected by many factors, which range from institutions and infrastructure to human capital and research, venture capital and state funding, and business sophistication. Higher R&D spending and R&D manpower are considered particularly necessary for innovation. For this reason, the EU has set a target to spend at least 3% of GDP on R&D by 2020, compared to a figure of 2.02% in 2019 for the EU-28[25]. The top 10 countries, which spend from 4.3% to 2.8% of their GDP on R&D, are South Korea, Israel, Finland, Japan, Sweden, Denmark, Austria, Switzerland, Germany and the US. In terms of the share of R&D personnel compared to the full labour force, Denmark, Luxembourg and Finland have the highest share in the EU (about 2% of their labour force) (Eurostat, 2019). Moreover, some locations perform better in specific sectors or technology areas (e.g. biomedical research in the US and Switzerland), despite the R&D investment across all countries. Thus, most countries in the world are still recipients of innovation and technological advances, although some emerging economies are also becoming trendsetters.

Some studies stress the importance to economies of technology absorption and diffusion rates for the improvement of their innovation capacity (Nedelkoska and Quintini, 2018). According to the World Economic Forum, the adoption of digital technologies can help developing countries to increase their share of the global services trade by about 15%[26]. Digital preparedness is becoming an important factor to explain country variations in the patterns of the seven identified trends. Internet use continues to be concentrated in advanced economies, and countries need to be prepared in terms of infrastructure and human capital to seize on the opportunities of the digital economy. Increasing internet penetration can create a national digital ecosystem that increases a country's chances of becoming a player and developing a homegrown digital economy that offers more tailored products. Many studies show the growth benefits of increasing broadband penetration and point to

[25] OECD, www.oecd-ilibrary.org/industry-and-services/gross-domestic-spending-on-r-d/indicator/english_d8b068b4-en
[26] www.weforum.org/agenda/2020/06/3-challenges-facing-global-gig-economy-growth-after-covid-19/

how the lives of individuals and communities are transformed by the arrival of the internet.

Participation in global value chains brings exposure to offshoring or reshoring trends and affects the occupational structure. For example, the German automotive sector has offshored manufacturing jobs in car production to Eastern European countries, where it has pushed up industrial employment and kept the level of job polarisation modest. As a result, upgrading the occupational structure towards higher paying jobs is visible in Eastern European countries, whereas the opposite tendency towards downgrading (further polarisation) is seen in other countries (e.g. Greece and Spain) (Eurofound, 2018c). Another example involves the decreasing provision in developed countries of IT services, which are increasingly being offshored to developing countries. The share of cross-border trade in services is currently greater than 25% of the value of total global exports, and an important proportion of these services comes from the global gig economy and labour. The dominant pattern of online workflow involves a client in the global north engaging in online outsourcing to a worker in the global south, who works on 'weightless' digital products that are easily transported for production spatially. Exposure to global value chains also accelerates trends in financialisation, a form of value creation and capture based on squeezing labour costs and revenues and increasing shareholder value, profits and flexibility (JRC, 2019b)[27].

The macro level and business environment in which organisations operate are also crucial when translating the global trends to a specific country context. The institutions in the business environment play an important role in shaping what happens within organisations in a country (e.g. financial incentives, legal concerns, restrictive codes and social standards). Uber failed to have its operating license renewed in London, Bulgaria, Hungary and Denmark because it was judged to have failed to comply with necessary regulations. This issue is also linked to the power relationship between actors with embedded interests, e.g. between capital and labour. The power relationship is dynamic and the balance changes over time. The introduction and implementation of any change in a country is delimited by this power

relationship (JRC, 2019b). At the meso and micro levels, firms' decisions on changes are affected by many organisational issues, for example, technical feasibility, the cost of change, product market strategies, and performance benefits including and beyond labour cost savings. If labour is cheap, the incentives to replace it with technology diminish. Other potential reasons include a lack of demand for technology among customers and a lack of awareness of the benefits of technology.

Labour market institutions are very context-specific too. Typically, industrial relations and public and welfare institutions in developing countries are quite different in nature to their counterparts in advanced countries. These institutions affect the wage distribution in countries, their working conditions and their occupational structure of employment. According to the OECD (Nedelkoska and Quintini, 2018), stronger employment protection legislation tends to amplify the effect of ICTs and automation (rigidity pushes firms to go digital), while stronger trade unions reduce the effect of job polarisation in the bottom segment of the employment distribution. In most OECD countries, medium-skilled workers have been pushed down to low-skilled jobs, but some medium-skilled workers in Sweden, Norway, Denmark and Germany have been able to move into high-skilled, high-paid occupations (through upgrading). This is explained by the corporate nature of social dialogue and stronger collective bargaining institutions at the sectoral and firm level, which facilitate dialogue and bargaining over skills, wages and staffing needs at the firm level. In these countries, labour legislation tends to protect workers rather than jobs (in what is called a flexicurity system), while stronger vocational education systems combine hands-on training with formal schooling (OECD, 2020).

Finally, human capital is a fundamental factor in shaping a country's performance and any variations in the trends across countries. Human capital is a measure of the skills, education, capacity and attributes of labour that influence its productive capacity and earning potential in an economy. The skills pool in a country (especially its medium- and high-skilled workers) determines its productivity and competitiveness, its capacity to innovate and absorb technological development, the sophistication of its business activities and the labour market participation of its population. Proper formation and use of human capital are needed to accomplish goals and adapt to change, because it takes human capital to create value and other forms of capital. In today's knowledge-based economy, what matters are the skills and competences of people (not just workers but also managers and other professionals).

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[27] According to the JRC (2019b), financialisation has shifted the balance of power to employers by reinforcing market discipline and market attitudes, and it has resulted in work intensification, income and job insecurity for workers, pressures to turn around profits on a short time scale, the squeezing of costs through redundancies, and outsourcing.

While a machine may eliminate the need to have hundreds of workers, it still takes human capital to design and build the machine. Demography can be a factor too. For instance, countries with a larger share of working population create greater economic dynamism. A country with an ageing population will be more open to digitisation and automation than a country with a booming population, but the latter could well have more young people with better digital skills.

Depending on a country's stage of economic development, its political system, its labour market and its human resources, its response to global changes can differ. Atypical jobs are increasing everywhere, but they are perceived more as a threat in advanced economies where a substantial portion of the labour force has standard full-time wage employment. In developing countries where there is a significant share of informal (self-)employment, low wages and poor law enforcement, for example, online outsourcing jobs provide new employment opportunities. The research shows that online workers in developing countries are fairly happy with their work, taking the view that the positives outweigh the negatives (Heeks, 2017). As they do not have the same perception of 'decent work', they see platform work as an improvement. According to Huws (2016), 'one way of looking at the growth of online platforms in service delivery is to see it as a formalisation of the informal economy, with the transparency of an open market replacing the old word-of-mouth methods of finding work, and the replacement of unrecorded cash-in-hand payments by trackable online payments opening up at least the possibility for taxes to be collected and fairness to prevail'.

As already implied in the previous paragraphs, the role of the state and the efficiency of its public administration should not be underestimated in transforming the economy and shaping the trends in each country. The state is crucial for building up the infrastructure of core technologies and investing in human resources. By putting in place adequate institutional arrangements, public administration practices, mechanisms, capacities, budgetary arrangements and resources, the state can exert a unique capacity to shape markets and set the direction for innovation. Because of its size and extraordinary resources, only the state can develop a lagging economy or society through efficient public policies and services (e.g. economic incentives, fair competition, and health and education services). When the state goes missing in times of radical change, problems such as climate change or inequality can become threats to the economy. As the UN has argued, Agenda

2030 'brought the state back' in response to the interdependence of the Sustainable Development Goals and related policy areas, because a well-functioning public sector is necessary to integrate areas that would not otherwise become integrated 'spontaneously' (UN, 2018).

1.4 What new skills[28] are needed in the face of these labour market trends?

While the evolving trends outlined above are shaping labour markets through changes to work organisation, occupations, task content, working methods and tools, and employment patterns, they are also changing the skills needs of economies and enterprises. The continuous divergence in the demand for and supply of skills has led to a growing skills mismatch everywhere, despite the dramatic increase in the education levels of populations. An increasing number of studies discuss skills gaps and skills shortages or obsolescence. Some studies even estimate a global shortage of medium- and high-skilled workers and a potential surplus of low-skilled workers (Janta et al., 2015). The various methodologies used to anticipate the demand for skills range from employer surveys and sectoral/regional studies to qualitative methods (including foresights) and quantitative model-based projections (forecasts). The latest innovative method is big data analysis, which provides real-time labour market intelligence on changing skills demands[29].

The increasing importance of intellectual and social tasks as well as tasks linked to human-machine interaction leads to an increasing demand for higher level cognitive and socio-emotional skills and a lower demand for manual skills owing to the decline in physical tasks. According to the World Bank (Cunningham and Villaseñor, 2016), **cognitive skills** help us to understand complex ideas, to adapt effectively to the environment, to learn from experience and to engage in various forms of reasoning to overcome obstacles. They include intelligence, reasoning, information-processing, perception, memory, literacy, numeracy, and learning, among others. The levels of these skills are

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[28] In this context, a skill is defined as the ability to apply knowledge and experience to complete tasks and solve problems related to work. The traditional classification includes high-skilled, medium-skilled and low-skilled, which are generally linked to the qualification levels of people. The ETF uses 'skills' in an open way, which is broader than qualifications.

[29] An interesting example is offered by online job portals, which are becoming a useful source for gathering information about the content and specificities of demand at the micro level.

basic cognitive, higher-order cognitive and technical. By contrast, **socio-emotional skills** are behaviours, attitudes and traits that are necessary complements to cognitive skills. They help us to understand ourselves, get along with others in teams, solve important social problems and resolve conflicts (ibid.). Socio-emotional skills may be even more important than cognitive skills for employment, especially among low-skilled occupations. Studies confirm a correlation between job performance and openness to experience, conscientiousness, extraversion, agreeableness in managing/coordinating, teaching/training/coaching, selling/influencing and serving/attending.

It is no coincidence that in 2018 the European Council revised and updated the 2006 EU recommendation on **key competences** for lifelong learning. Consequently, investment in basic skills, knowledge and attitudes has become more important than ever. Such investment lays the foundation for societies that are more equal and more democratic. Designed as a combination of higher-level cognitive and socio-emotional skills, the European Reference Framework sets out eight key competences not only for personal fulfilment, employability and social inclusion, but also for health conscious, future-oriented life management, active citizenship in peaceful societies and sustainable development. The eight competences are literacy; multilingualism; numerical, scientific and engineering skills; digital and technology-based competences; interpersonal skills and the ability to adopt new competences; active citizenship; entrepreneurship; and cultural awareness and expression. In a rapidly changing and highly interconnected world, each person will need to acquire this wide range of skills and competences and develop them continually throughout life as non-formal and informal learning and lifelong learning become increasingly important.

Within this context, heightened attention has been placed on STEM subjects (science, technology, engineering and mathematics) and **STEM skills**. The latter are defined as those skills possessed by people with a higher education in STEM subjects (European Commission, 2015a)[30]. They are considered essential for innovation-driven economic development and the creation of a competitive edge in robotics and artificial intelligence. However, STEM skills are not only for graduates of higher education. In the EU, the current demand for STEM skills calls for both upper-secondary and university graduates and the trend is expected to persist. In 2015, 48% of STEM-related occupations required medium-level qualifications, which are mostly acquired through upper- and post-secondary vocational education and training. This figure is forecasted to fall to 46% by 2025 (European Parliament, 2015). In response to this demand, the EU STEM Coalition was launched in October 2015 to help in the development and implementation of national strategies to promote STEM disciplines across Europe (European Schoolnet, 2018). The European Commission has initiated and funded many projects and studies to make science education and careers attractive for young people, and to improve the quality and relevance of STEM skills development. While countries need to have an adequate supply of STEM skills both at medium and high levels, some experts argue that any comparative advantage comes from being different, e.g. when STEM skills are combined with other fields of knowledge and soft skills (Brown et al., 2015).

A special focus has been placed on **digital skills** as a key competence needed by all citizens (basic ICT) and as a technical competence needed by some professions. As a result of increasing digitisation, nearly every kind of job will require digital literacy. According to the EU's Digital Skills and Jobs Coalition, 90% of all jobs will require some level of digital skills in the near future, but today about 43% of Europeans still do not have a sufficient level of digital skills and 17% have none at all, based on the 2018 Digital Economy and Society Index. While digital skills can compensate for a lack of formal higher qualifications, the opposite does not hold true and a lack of digital literacy may severely impair future wage and job prospects (JRC, 2019a). Within this context, an EU tool to support the development of digital competences, the EU Digital Competence Framework, was adopted in 2016 (Vuorikari et al., 2016), and new guidelines for its implementation were adopted in July 2020 (Kluzer et al., 2020). Specifically, digital skills involve the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. They include information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property-related questions, problem solving and critical thinking (ibid.).

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[30] These skills include 'numeracy and the ability to generate, understand and analyse empirical data including critical analysis; an understanding of scientific and mathematical principles; the ability to apply a systematic and critical assessment of complex problems with an emphasis on solving them and applying the theoretical knowledge of the subject to practical problems; the ability to communicate scientific issues to stakeholders and others; ingenuity, logical reasoning and practical intelligence' (European Commission, 2015a).

Entrepreneurial skills are another key competence required by individuals to adapt to changing forms of employment and enhance their flexibility and labour mobility. What constitutes entrepreneurial skills, however, has been the subject of much discussion. They are not related to a specific occupation, discipline or qualification; rather, they combine a range of technical, management and personal skills (European Commission, 2015b). Entrepreneurial skills include creativity, innovation and risk-taking, as well as the ability to plan and manage projects in order to achieve objectives. They can also be used across people's personal and working lives because they encompass 'creativity, initiative, tenacity, teamwork, understanding of risk, and a sense of responsibility' (ibid). Thus, individual entrepreneurship is often a role model of such skills, but the ILO also emphasised the importance of a collective mode of entrepreneurship for larger social impact, as cooperatives can be some of the most resilient business models in times of crisis (Birchall and Ketilson, 2009). Entrepreneurial skills provide benefits regardless of whether a person sees starting a business in his or her future, although fostering an entrepreneurial spirit also supports the creation of new firms. Within this context, the EU adopted the Entrepreneurship Competence Framework *(EntreComp)* in 2016 as a tool to foster the entrepreneurial capacity of European citizens (Bacigalupo et al., 2016)[31].

Overall, disruptive trends require a **new mindset** that enables individuals to use new technologies and be more resilient to changes. The new mindset in question includes a skills set that is described in a variety of ways in the international literature. JRC (2019a) calls them 'non-cognitive skills', but they are also called transversal or **soft skills**, personality traits, character skills, 21st century skills, life skills, etc. These skills are not always well defined and agreed upon in the literature, because they relate to different properties or attributes of individuals, for example, open-mindedness, openness to learn and to change, flexibility, curiosity, innovation, creativity, resilience, persistence, initiative, sociability, empathy, emotional control and positivity. Some employers have asked to stop calling them

soft skills[32] because the wage premium for soft skills has increased significantly over time. This combination of skills and attitudes is necessary for the adaptability of individuals, and there is a great deal of evidence that employers have increasingly prioritised soft skills equal to or above technical skills (NESTA and City of London, 2019). The terms and definitions of these skills are still confusing, because they are fluid and in continuous evolution. What is certain, however, is that it is a challenge to assess them and they are often not explicitly thought through in curricula.

In the context of rapidly changing and fluid labour markets, a new type of skills is becoming important: **career management skills**, which enable people to navigate and manage their careers in a context of complexity and uncertainty (ETF, 2019b). People are expected to be more autonomous in shaping their careers. They are now obliged to make more frequent transitions from education to work and training as well as from their first job to their second and third jobs. They must permanently adapt their skills sets and they must learn new concepts, acquire new knowledge and master new competences at a very high speed. Increasingly, individuals (young people and adults alike) are now responsible for managing their own working lives, and they face heightened pressure on learning. Learning, unlearning and relearning would seem to be the only way to adapt to changes (Akay, 2014)[33]. Therefore, people need to be agile and resilient in the face of ever-increasing changes in labour markets and they must make the right learning and career decisions.

Environmental challenges and the policy objective of greening our economies have also brought to the forefront the need for **green skills**. There is no common definition of green skills, but there is a broad approach: 'abilities needed to live in, develop and support a society which aims to reduce the negative impact of human activity on the environment' (Cedefop, 2014). Australia calls them 'skills for sustainability' and defines them as 'the technical skills, knowledge, values and attitudes needed in the workforce to develop and support sustainable social, economic and environmental outcomes in economic and social life'[34]. Green

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[31]   EntreComp consists of three interrelated and interconnected competence areas: 'ideas and opportunities', 'resources' and 'into action'. Each area is made up of five competences, which together constitute the building blocks of entrepreneurship as a competence. The framework develops the 15 competences along an 8-level progression model and proposes a comprehensive list of 442 learning outcomes. The framework can be used as a basis for the development of curricula and learning activities that foster entrepreneurship as a competence (Bacigalupo et al., 2016).

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[32]   'Soft skills are far too important to be called soft [...] these non-technical skills are more essential than technical skills when it comes to hiring people who are likely to progress the most rapidly' (LinkedIn employer, May 2020).

[33]   This is called 'learning agility': the ability and willingness to learn from experience and subsequently apply that learning to perform successfully under new or first-time conditions (Akay, 2014).

[34]   See www.ivet.com.au/

skills appear to consist of technical or subject-specific competences, generic interdisciplinary competences and normative aspects (visions, values and preferences). Generic green skills are necessary to develop awareness-raising, resource-efficient living and eco-citizenship[35], whereas specific green skills are required to implement standards and processes to protect ecosystems and biodiversity, and to reduce energy, materials and water consumption. Finally, highly specialised green skills are those needed to develop and implement green technologies such as renewable energies, sewage treatment and recycling (Cedefop, 2014).

Another trend affects the changing nature of skills sets, which now encompass a wider, often **multidisciplinary range of skills**. Some use the term 'fusion skills' to cover the combination of soft skills and technical skills that people will need to succeed in the future. This concept builds on the idea that a merging and blending of skills and industries – including the arts, design, technology and business – are key components of the changing labour market, requiring the fusion of expertise, knowledge and experience in individuals (NESTA and City of London, 2019). Others mention 'composite skills', which are created by using two or more skills in harmony, simply linking them together while still retaining the original skills. 'T-shaped skills' is another term used by employers to define the desirable attributes of workers. In this case, the vertical bar of the letter T represents the depth of related skills and expertise in a single field, whereas the horizontal bar represents the ability to collaborate across disciplines with experts in other areas and to apply knowledge in areas of expertise other than one's own (Akay, 2015)[36]. Other new terms are also being used to describe the demand for workers with multiple expertise areas. Examples include pi-shaped skills (a broad base with two areas of expertise, creating the shape of the Greek letter pi), comb-shaped skills (a broad base with multiple

areas of expertise, creating the shape of a comb), etc. (ibid).

In this new environment, some experts propose focusing on **capability** rather than competence, which is seen as somewhat outdated and passive (ATD, 2020). Competence refers to a person's current state, that is, whether he or she has the knowledge and skills necessary to perform a job. By contrast, capability is about integrating knowledge and skills and adapting and flexing to meet future needs (ibid)[37]. Whereas the skills required to carry out any given task will inevitably become obsolete, the capabilities to understand the context, play with alternative solutions, and develop and creatively apply new techniques to achieve results will endure beyond any change (Deloitte, 2019). Human capabilities transcend specific skills domains; they underlie the ability to learn, apply and effectively adapt them: 'In an economy that desperately needs more and more new skills, refreshed more and more often, what becomes most important are not the skills themselves but the enduring human capabilities' (ibid.)[38].

The above discussion demonstrates that a multiplicity of terms are now in use internationally to describe skills and the changing demand for skills. Sometimes the terms overlap and sometimes they intersect. However, they all point towards the same conclusion. In our post-industrial times, in addition to the specific technical skills needed to use technology and perform certain tasks, there is an entire array of other skills that people need to possess in order to get the most out of changing labour markets and perform effectively in different work-related settings as employees, self-employed

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[35] According to the European Commission (Skills Panorama, 2015), generic green skills involve a capacity to include environmental concerns in decision making, such as in the selection of processes and technologies. Sometimes they are called 'environmental awareness skills'. The EU adopted the European Green Deal as a roadmap to make the EU's economy sustainable and climate neutral by 2050 (COM(2019) 640 final).

[36] 'T-shaped' has been popularised by Tim Brown, the CEO of IDEO, when describing the type of employees he prefers to employ in his company. According to Brown, the depth of expertise in a single field (vertical bar) is necessary to contribute to the creative process, while the horizontal bar points to the ability to collaborate across disciplines. The latter is linked to empathy and curiosity. The profile combines a specialist and a generalist into one 'generalising specialist' (Akay, 2015).

[37] This is not to be confused with the 'capability approach' promoted by the economist and philosopher Amartya Sen in the 1980s as an alternative approach to welfare economics. However, Sen's core focus (what individuals are able to do, i.e. as 'agents' who act and bring about change) also emphasises that development calls for the expansion of capability (education, health, etc.).

[38] According to Deloitte (2019), skills were valuable and necessary in the 20th century, when business operated in a stable, predictable environment with standardised efficiency processes. In the new world, however, focusing on skills alone is not the answer to building the workforce of the future. Enduring human capabilities are observable human attributes that are demonstrated independent of context; they are universally applicable and timeless. They include the innate capabilities that we are born with and that can be amplified (e.g. curiosity, imagination, creativity, empathy and resilience), as well as other capabilities developed through experience and practice (e.g. social and emotional intelligence, teamworking, critical thinking, sense-making and adaptive thinking). They are key to creating the new value that the market demands and encouraging people to explore and master new skills on their own initiative.

people and entrepreneurs. These may be key competences (competences that everybody must have), but they may also be attitudes and a mindset to be able to adapt to and support change. As the famous futurologist Alvin Toffler put it, 'the illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn' (Akay, 2014).

1.5 Conclusions and a final word of caution

This paper has aimed to present an overview of global trends, their impact on labour markets and the resulting changes in the demand for skills, based on what we know from the existing literature. The need to understand ongoing developments and the resulting changes in current and future skills needs has become crucial, since the economic and social costs of skills mismatches are substantial for individuals, firms and societies. Yet we do not have a crystal ball to see into the future. The impacts remain uncertain and controversial because our knowledge is limited and still in development. To anticipate the demand for skills requires constant monitoring of labour markets and workplaces (whether physical or virtual), as well as continuous research, data analysis, assessment and learning by doing. Institutions and people need to act under the assumption that future predictions are partial, imperfect, and subject to multiple disruptive factors. Nevertheless, it is the human responses to the changes that will determine the evolution of future labour markets in every country, as the changes give rise to opportunities and risks.

The final outcomes are driven by countries' visions for their future, which are often linked to their state of economic development and their level of human capital. The result is shaped by choices made by public institutions, economic actors and political elites, mainly based on their interactions and motivated by their self-interest and normative considerations. No country is locked into a single future; rather, each country has a number of possible futures, depending on its choices. Countries need to manage the transition towards the future, taking into account an array of factors (ETF, 2019b). The context or starting point – i.e. a country's capacity to make a realistic analysis of where it stands and where it wants to go – is important. Also important are making the right choices and implementing actions to mitigate challenges and seize opportunities. The institutional capacity and the ability of actors to work collectively are crucial to managing change in any country. The future calls for the resilience, adaptability and agility of all actors. Above all, however, shaping

the future is about people. Investing in people is becoming more important than ever, because improving people's competences (human capital) is a key factor in adaptability and innovation, and it is necessary for a human-centric and inclusive development paradigm.

The Covid-19 health crisis has once again reminded us of the difficulty of predicting the future, calling into question the validity of many studies and forecasts about future labour markets. At least temporarily, the quarantine period of the pandemic has curtailed economic activity and market demand for production, trade and consumption, both at the national and international levels. There is now much ongoing debate over the future impact of the Covid-19 pandemic, ranging from the loss of GDP growth and income to business bankruptcies and labour layoffs, rising unemployment, falling earnings, sick leave and other disrupted work activities resulting from social distancing. Attention is also being directed at inequality, the vulnerability of low-paid temporary workers and self-employed people, and a more visible lack of social protection within the gig economy (e.g. zero-hour contracts). Covid-19 has accelerated the speed of changes and increased the need for a fundamental reform of systems and institutions. It has become a cliché to say that the world will never be the same.

If the Covid-19 pandemic has a winner, it is the digital technologies that make the new normal possible and keep countries functioning in a time of lockdowns. The accelerating effect of the pandemic on key technology trends is visible in areas such as online shopping and robot deliveries, digital and contactless payments, remote work, distance learning, telehealth, e-commerce and e-government, online entertainment, supply chain 4.0, 3D printing, robotics and drones, 5G and ICT[39]. For some experts, the Covid-19 crisis has hastened the arrival of the 'future of work'[40]. Lockdown has seen the widescale use of digital technologies and remote working. For many white-collar workers, for instance, it has meant working remotely. For many service and blue-collar workers, it has opened a window into a future where machines may displace

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[39] As people scramble to work and socialise remotely, previously niche tools, such as Zoom, Slack, Microsoft's Teams and the Houseparty app, are suddenly supporting millions of personal and corporate interactions every minute. See WEF, www.weforum.org/agenda/2020/04/10-technology-trends-coronavirus-covid19-pandemic-robotics-telehealth/

[40] See WEF, www.weforum.org/agenda/2020/05/covid-19-automation-globalisation-coronavirus-world-pandemic-change/?utm_source=sfmc&utm_medium=email&utm_campaign=2719193_Agenda_weekly-15May2020&utm_term=&emailType=Newsletter

people, especially as firms consider increasing automation to enhance their future resilience. For the health, education and care sectors, it has led to a long overdue global re-evaluation of the significance and essential nature of these services.

The pandemic has also exposed the vulnerabilities of global value chains, which are characterised by high interdependencies between global lead firms and suppliers scattered over several continents. To some extent, this may create an impetus for more automation and less globalisation (i.e. reshoring), at least temporarily. New labour-saving technologies could potentially reduce the reliance of manufacturing on low-skilled, low-cost labour and have implications for the geography of production (sometimes called deglobalisation). Although it is far from certain, some value chains may gradually alter to become more regional in nature, moving closer to consumer markets because of the risk-averse behaviours of businesses that feel an urge to shift from 'just-in-time' to 'just-in-case' scenarios. Given the temptation for states to adopt more protectionist policies on behalf of domestic firms and workers, the post-pandemic world may be marked by tighter restrictions on the movement of goods, services, capital, labour, technology, data

and information, at least temporarily (e.g. food and medical supplies).

Last but not least, there are many ways to look at skills under conditions of permanent uncertainty. Skills are not necessarily a rare quality. Rather, they are diverse and multifaceted; everyone has them to some degree and in some form. This can be observed in the changing definitions of intelligence itself: IQ (intelligence quotient), EQ (emotional intelligence), LQ (the quotient of love). As a consequence, there is a wide pool of skills to work with, if countries or companies can only learn how to tap into them. Innovation sometimes comes from permitting the entire workforce to think rather than limiting thought to a small elite group of employees. The quality of the workplace as a social environment is a major determinant of the competitiveness of individuals, firms, regions and nations (Brown et al., 2015). The translation of skills into performance depends on many factors in the workplace, such as employee engagement and the opportunity to use employees' knowledge and skills in work-related activities. Thus, future labour markets will require broader thinking on a host of issues ranging from labour market opportunities, job design and skill utilisation to income distribution, career mobility and a skilled workforce.

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ARTICLE 2
HOW ARE LABOUR MARKETS EVOLVING? AN OVERVIEW OF TRANSFORMATIONS IN THE COUNTRIES NEIGHBOURING THE EUROPEAN UNION

Ummuhan Bardak, with contributions from Anastasia Fetsi, Francesca Rosso and Mircea Badescu

2.1 Introduction

This article covers around 30 countries in the European Neighbourhood region, which are called 'partner countries' by the ETF. They include six countries in the Western Balkans (Albania, Bosnia and Herzegovina, Kosovo[1], Montenegro, North Macedonia and Serbia) plus Turkey as part of the enlargement region. In the Eastern Neighbourhood there are another six countries (Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine), making up the so-called Eastern Partnership region, while relations with the Russia are managed separately. The Southern Neighbourhood is surrounded by the Arab Mediterranean countries (Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine[2], Syria and Tunisia). Despite its high-income status, Israel is part of this region. Finally, the countries of Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) are often considered as the 'neighbours' of the European Neighbourhood, and they are also included in this article.

Consideration of context forms a very important starting point for the analysis here, and is a prerequisite to understanding where these countries stand. Although the countries in the European Neighbourhood Region are very diverse, for the purposes of future debate, this article focuses more on their similarities. The most fundamental commonality in the European Neighbourhood countries is that they are middle-income countries (either lower-middle income or upper-middle income); most of them being recipients of technological advances rather than being the creators of technology or trendsetters.

Their economies are affected directly or indirectly by the global drivers summarised in the Article 1, while trends such as automation, robotics and industry 4.0 are also making in-roads into their labour markets.

Many broad movements of change can be observed in labour markets at the global level (see Article 1 for a thorough analysis). These trends affect all countries, and those surrounding the European Union (EU) are no exception. The effects, however, are different in each country depending on its socio-economic structure and internal dynamics, from institutional and political leadership to business and regulatory environment, economic sectors and labour force, innovative capacity, technological adoption and human capital development – each producing a country-specific outcome. More details about country differences, particularly on the human capital development aspects, may be found in the ETF Torino Process assessments 2019–20[3].

This article attempts to identify the emerging skills needs in the European Neighbourhood countries caused by the global trends of change identified in Article 1. In order to do so, it reviews the main structural features of the region in terms of the evolution of labour markets, as contextual analysis is a prerequisite to understanding where these countries stand. Section 2.2 starts with this contextual review to demonstrate countries' position in the world. Section 2.3 makes observations on how they are being affected by the global drivers of change and gives examples of the ensuing dynamics in different countries, which then provides criteria to assess what new skills needs are emerging. Section 2.4 continues by looking at the emerging skill demands in the various labour markets and discusses how ready the region is to face the future. The article ends with a few final reflections in Section 2.5.

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[1] This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence – hereinafter 'Kosovo'.

[2] This designation shall not be construed as recognition of a State of Palestine and is without prejudice to the individual position of the Member States on this issue – hereinafter 'Palestine'.

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[3] www.etf.europa.eu/en/publications-and-resources/publications/trp-assessment-reports

2.2 Where do the European Neighbourhood countries stand?

This section reviews the most important factors in understanding the position of the EU neighbouring countries (as identified in Article 1) in the world. These are: economic framework and trade relations; the key characteristics of labour market structures; types and levels of vulnerable groups; the level of technology absorption and innovation; and human capital formation and the skills pool.

2.2.1 Middle-income economies with open trade

With few exceptions, most of the European Neighbourhood countries have middle-income status, with substantial variations from low to high middle-income. The GDP per capita levels reveal that Israel enjoys a high-income status, followed by Russia, Kazakhstan, Turkey, Montenegro and Belarus, which have income levels in the upper-middle bracket (Figure 2.1). Countries like Tajikistan and Kyrgyzstan have very low levels of GDP per capita, followed by Moldova, Palestine and Morocco. At the same time, the countries with lower GDP per capita tend to be quick to catch up, as the GDP increase over 2010–18 has been the highest in the low-per-capita countries. Countries

like Turkey, Georgia, Armenia, Moldova, Kosovo and Palestine also grow more than others, although political or health crises continue to disrupt their economic growth.

A review of GDP growth between 2010 and 2018 in the European Neighbourhood countries shows a modest but consistent rise for many of them – and a higher growth rate than seen in the EU. Turkey, Georgia, Armenia, Moldova, Israel, Kosovo, Morocco, Palestine and Egypt have been able to achieve an average annual growth rate of 3–5%. The countries with the highest GDP growth are those in Central Asia (Uzbekistan, Turkmenistan, Tajikistan, Kyrgyzstan, Kazakhstan). At the same time, the GDP growth rates in some other countries were severely disrupted and fell to zero or below due to economic or political crises, such as Russia, Ukraine, and Belarus. In comparison with some emerging economies in East Asia that have double-digit growth rates (e.g. China), GDP growth is rather slow in this region, making it difficult for these countries to catch up.

The mixed economic trends have been mainly the result of the worldwide economic recession after the global financial crisis of 2008 (ETF, 2019b). Although 2013 marked a period of recovery from

Figure 2.1. GDP per capita (PPP crt. $) in the EU Neighbourhood (2018) and % change of GDP per capita in 2010–18
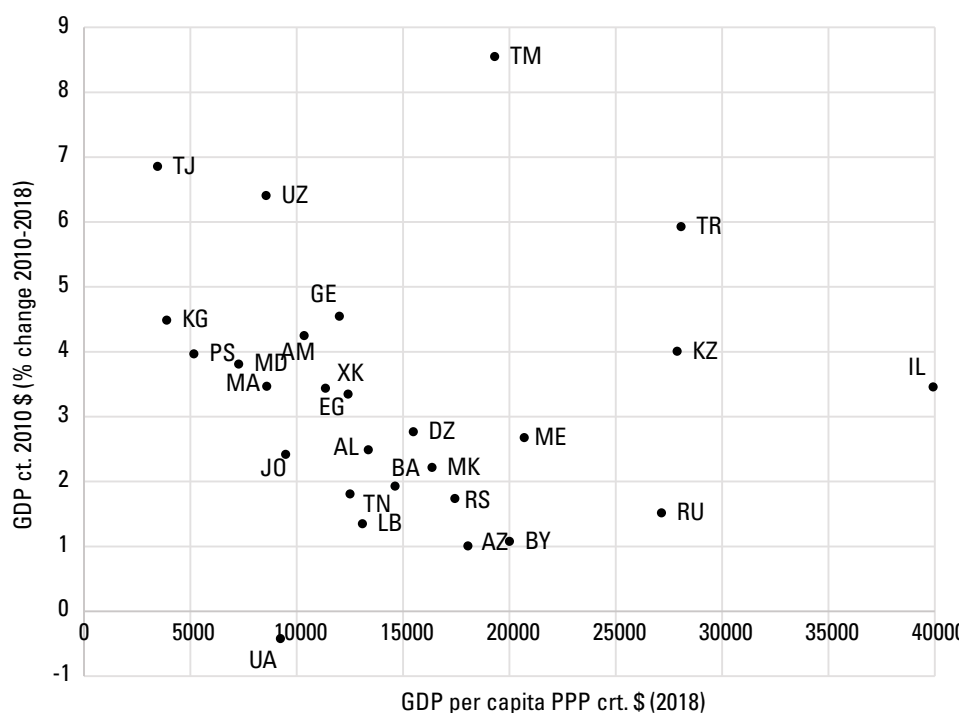
Note: A list country codes is given in Table 2.1, PPP – purchasing power parity, crt – current/nominal $, ct – constant (i.e. real/adjusted for inflation).

Source: World Bank database of World Development Indicators (WDI).

economic recession for many countries, there has generally been less success in transforming this economic recovery into job creation. The current global health crisis is exerting a similar negative effect on countries' economies, leading to a significant contraction in 2020 and 2021. A second, stronger wave of the pandemic since September is further delaying economic recovery in the region. Travel restrictions and social distancing measures have also depressed growth in countries with a strong tourism sector. In addition, with falling demand for many goods and services at the global level, international trade and levels of foreign direct investment (FDI) are also decreasing in the region, leading to lower productivity and competitiveness.

According to the World Bank's *Regular Economic Report* (2020), for example, economic growth in the Western Balkans is forecast to contract by 4.8% in 2020. The pandemic is thus further challenging labour markets in the region, with the economic transition process and many critical reforms (e.g. enterprise restructuring and the business environment) subject to longer delays.

The gross value added by broad economic sector shows services contributing the most to GDP in the majority of countries, varying from close to half to two-thirds of GDP (see Table 2.1). The cases where services represent a value lower than one-third of GDP are very few (Turkmenistan, Uzbekistan and Azerbaijan) and mainly linked to the extraction of natural resources (i.e. oil and gas). On the other hand, the GDP share of industry is smaller and has been stable (or small decrease) as a general trend – albeit with exceptions (Georgia, Israel, Kosovo, Kyrgyzstan and Uzbekistan). Among the sub-sectors showing an upward growth trend are, from the service sector, wholesale and retail trade, transport, hospitality, financial services, real estate and renting activities, education and health. From the industrial sector, some countries experienced slight growth due to construction, mining and quarrying, chemicals, textiles, light manufacturing such as machinery, household products and foodstuffs. Strong private consumption on the back of high remittances and development aid, along with private and public wage growth are other factors contributing to GDP growth.

Table 2.1. Gross value added by broad economic sectors (% of GDP), 2019

COUNTRY (COUNTRY CODE)	AGRICULTURE (1)	INDUSTRY (2)	SERVICES (3)	OTHER (4)
Albania (AL)	18.6	20.1	48.6	12.7
Algeria (DZ)	12.0	37.4	45.9	4.7
Armenia (AM)	12.0	24.3	54.2	9.5
Azerbaijan (AZ)	5.7	48.7	37.4	8.2
Belarus (BY)	6.8	31.3	48.8	13.1
Bosnia and Herzegovina (BA)	6.1	23.7	55.5	14.7
Egypt (EG)	11.0	35.6	50.5	2.9
Georgia (GE)	6.2	20.0	60.4	13.4
Israel* (IL)	1.2	20.2	68.2	10.4
Jordan* (JO)	5.1	28.2	61.1	5.5
Kazakhstan (KZ)	4.4	33.1	55.5	7.0
Kosovo (XK)	6.9	26.6	47.4	19.2
Kyrgyzstan (KG)	12.1	27.6	50.2	10.1
Lebanon (LB)	5.3	12.8	75.9	6.0
Moldova (MD)	9.9	22.8	54.2	13.1

(*continued*)

COUNTRY (COUNTRY CODE)	AGRICULTURE (1)	INDUSTRY (2)	SERVICES (3)	OTHER (4)
Montenegro* (ME)	8.1	14.4	60.3	17.3
Morocco (MA)	11.4	26.0	50.0	12.6
North Macedonia (MK)	8.8	24.0	54.6	12.6
Palestine* (PS)	3.6	18.9	64.0	13.5
Russia (RU)	3.4	32.2	54.0	10.4
Serbia (RS)	6.2	25.6	51.2	17.0
Tajikistan* (TJ)	21.9	24.4	42.5	11.2
Tunisia (TN)	10.3	25.0	57.4	7.4
Turkey (TR)	6.4	27.7	55.9	10.0
Turkmenistan* (TM)	9.3	57.0	28.1	1.4
Ukraine (UA)	9.0	22.6	54.4	14.0
Uzbekistan (UZ)	25.5	33.2	32.2	9.1

Notes: (1) includes agriculture, forestry and fishing; (2) includes industry and construction; (3) includes all services; (4) includes other non-observed/informal or cash/parallel economy activities. * Data for 2015.

Source: World Bank, WDI database (last accessed 16 September 2020).

The sector which contributes least to GDP is agriculture, and its share has decreased in all countries, although its contribution varies each year according to weather conditions. The countries with a larger agricultural sector maintain a relatively higher GDP share in this sector, typically over 10% (Albania, Armenia, Algeria, Egypt, Kyrgyzstan, Morocco, Tunisia, Tajikistan and Uzbekistan). The GDP share of the broad economic sectors have remained about the same in Bosnia and Herzegovina, Serbia, Ukraine, Moldova, Turkey, Russia, Morocco and Tajikistan. What is interesting is the fourth category of 'other', which is quite sizeable (over 10%) in many countries and has tended to increase over the last decade. This category typically corresponds to the non-observed or informal economy, including what households produce for their own use, and even illegal activities (such as the production and selling of drugs or other illicit undertakings).

As open (and mostly small) economies that are integrated into global production and trade flows to differing degrees, most of these countries are dependent on global trends and are sensitive to external shocks or political tensions (ETF, 2019b). Trading figures indicate the dependence of domestic producers on foreign demand (export) and of domestic consumers and producers on foreign supply (import), relative to the country's economic size. Looking at the general statistics, countries like Belarus, Georgia, North Macedonia, Serbia, Montenegro, Kyrgyzstan, Turkmenistan and Ukraine are highly dependent on foreign trade. It is important to highlight that, in general, most of the neighbour countries have suffered from chronic trade deficits in goods and surpluses in services.

According to World Bank data, the share of exports in GDP ranges between approximately half and two-thirds in Belarus, North Macedonia, Azerbaijan, Serbia, Georgia, Tunisia, Ukraine and Montenegro. On the opposite side, the exports of Egypt, Palestine, Turkey and Lebanon account for about one-fifth of their GDP (see some of them in Figure 2.2). In 2018, before the Covid-19 crisis, some countries attracted relatively higher FDI, as net inflows relative to their GDP – e.g. Albania, Azerbaijan, Georgia, Montenegro, Serbia, Tunisia, Lebanon and Russia. Another indicator is remittances as a share of GDP: this figure approaches one-third of GDP in Kyrgyzstan and Tajikistan, while it varies from 10% to 15% in Moldova, Kosovo, Uzbekistan, Lebanon, Ukraine, Georgia, Montenegro, Jordan, Egypt and Bosnia and Herzegovina (see Figure 2.2).

Figure 2.2. Exports, FDI flows and remittances as % of GDP in the EU neighbourhood, 2018

Legend: ■ Exports (% of GDP) ● FDI flows (% of GDP) ● Remittances (% of GDP)

Values (Exports): MK 60.3, AZ 54.3, RS 50.8, TN 48.9, UA 45.2, ME 42.9, BA 40.6, MA 38.7, AM 37.8, JO 35.6, AL 31.7, MD 29.3, LB 23.3, PS 19.9, EG 18.9
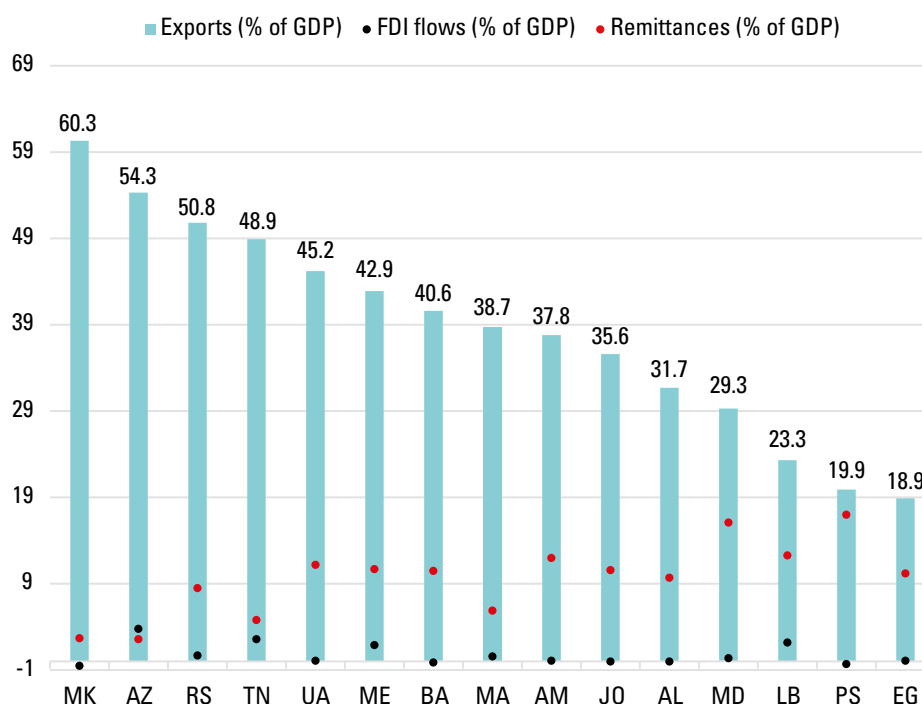
Source: World Bank, WDI database.

2.2.2 Untapped potential in the labour markets

As with the GDP shares by sector, employment in the neighbouring region is dominated by services, ranging from around 40% to just over 80% of total employment (Figure 2.3). The employment share of services is particularly high in Israel, Jordan and Montenegro, followed by Russia, Kazakhstan, Lebanon, Palestine and Serbia. However, the agricultural sector is still an important source of employment in some countries, especially Azerbaijan, Turkmenistan, Uzbekistan, Kyrgyzstan, Tajikistan, Georgia, Albania, Armenia, Egypt,

Figure 2.3. Share of employment in agriculture, industry and services, 2019 (%)

Agriculture:
- 0-10%: IL: 1.0, JO: 1.7, EU: 4.3, LB: 4.0, XK: 5.2, RU: 5.8, PS: 6.1, ME: 7.1, BY: 8.7, DZ: 9.6
- 11-20%: TN: 13.7, UA: 13.7, MK: 13.9, KZ: 14.1*, RS: 15.6, BiH 18.0, TR: 18.1, KZ: 19.9*, TM: 19.9
- 21-30%: MD: 21.0, KG: 23.0*, EG: 21.6*
- 31-40%: AM: 31.3*, MA: 38.0*, AZ: 36.0, GE: 38.2, AL: 36.4, TJ: 44.9

Industry:
- 0-15%: AM: 13.1*, AZ: 14.7, GE: 13.9
- 16-25%: TJ: 15.7, JO: 16.4, IL: 16.5, ME: 19.4, LB: 20.0*, AL: 20.1, MD: 21.7, MA: 21.1*, KG: 23.1*, EU: 24.8
- 26-30%: UA: 25.1, TR: 25.3, RU: 26.8, EG: 26.8*, XK: 27.6, RS: 27.4, DZ: 29.7, PS: 29.7
- 31-45%: BY: 30.1, MK: 31.1, BiH 31.7, TN: 34.4, TM: 42.4

Services:
- 0-35%: N/A
- 35-50%: TM: 37.7, TJ: 39.4, MA: 40.8*, AL: 43.5, GE: 48.0, AZ: 49.3
- 51-60%: BiH: 50.3, EG: 51.3*, TN: 51.9, KG: 53.8*, MK: 55.0, AM: 55.5*, TR: 56.6, RS: 56.9, MD: 57.3
- 61+%: BY: 61.2, UA: 61.2, DZ: 61.6, PS: 64.2, KZ: 66.0*, XK: 67.1, RU: 67.4, EU: 70.1, ME: 73.1, LB: 76.0, IL: 82.5, JO: 81.9

Notes: Industry includes construction. * Data for 2018 or 2017.

Source: KIESE database (ETF, 2020a), Eurostat and ILOSTAT.

Moldova and Morocco, accounting for around or above one-third of total employment. Conversely, Israel, Russia, Jordan, Montenegro and Belarus have very low levels of employment in agriculture. Agricultural employment in the rest (the majority) varies from 10% to 20%. On the other hand, employment in manufacturing remains relatively small, with construction forming an important part of the sector. When construction is excluded, the share of the manufacturing sector varies from 15% to 25% of total employment in most countries.

Compared to advanced economies, the European neighbourhood countries have a small number of good quality jobs. Jobs with decent working conditions and permanent contracts are scarce and excite a great deal of competition among medium- and high-skilled workers. The employment landscape is dominated by low-skilled and poorly paid jobs with a high degree of vulnerability. With falling global demand and a lack of FDI impacting productivity and competitiveness, most countries find themselves in a situation marked by low productivity and low-skill equilibrium, while at the same time experiencing high levels of informality and precariousness in the labour market (Bardak and Rosso, 2019). For example, informal employment ranges from between around a quarter to a third of all employment in some

countries (Serbia, Ukraine, North Macedonia, Moldova, Bosnia and Herzegovina, Kazakhstan, Russia and Turkey) to about a half to two-thirds of employment in others (Armenia, Azerbaijan, Albania, Egypt, Morocco, Palestine, Syria, Tajikistan and Tunisia) (ILO, 2018a).

In general, there is a tendency towards lower activity and employment levels among the working-age population compared to the EU-28 average (ETF, 2019b). In terms of the 15+ population, employment rates are relatively high in Kazakhstan, Azerbaijan, Turkmenistan, Uzbekistan, Israel, Belarus, Russia, Georgia and Kyrgyzstan (Figure 2.4). In countries with a large agricultural sector (e.g. Azerbaijan, Turkmenistan, Uzbekistan, Kyrgyzstan, Tajikistan and Georgia), this is hardly surprising, due to the high prevalence of underemployment in subsistence agriculture. Albania, Armenia, Egypt, Moldova and Morocco can be mentioned in this context as places where agriculture keeps the employment rate relatively high. Some other countries, such as Kosovo, Palestine, Jordan, Algeria, Tunisia and Bosnia and Herzegovina, have a problem with low employment, defined as below 40%. This is linked to high rates of female inactivity in these countries, but broader issues of 'discouraged workers' and severely disadvantaged groups with low functional literacy are other important factors.

Figure 2.4. Employment rates (15+) in the European Neighbourhood, 2019
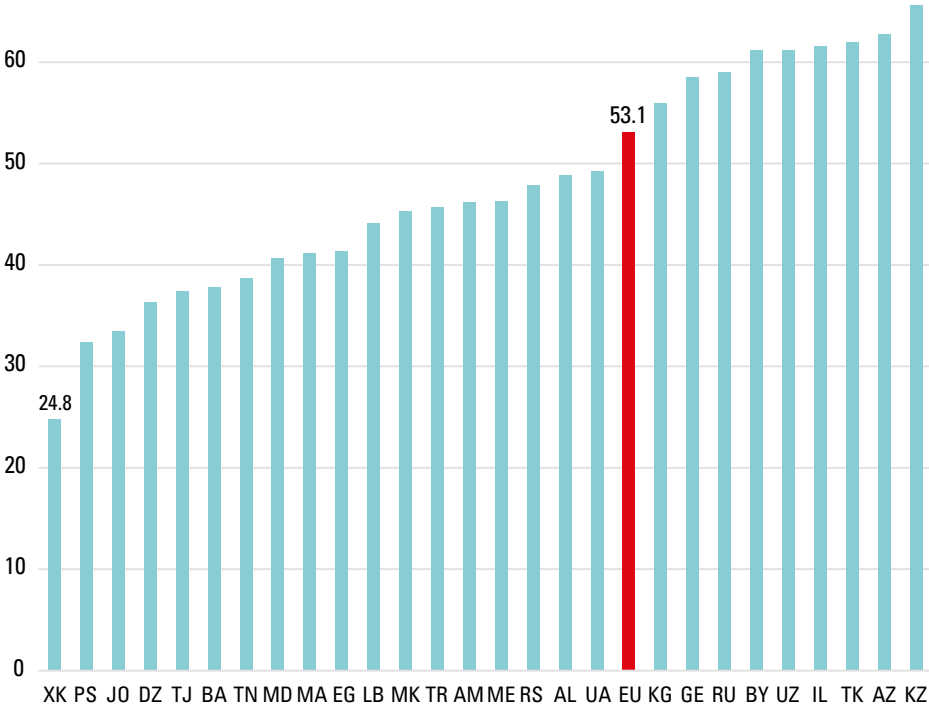
Note: The EU figure is the average of 28 Member States.

Source: KIESE database (ETF, 2019a), ILOSTAT, Eurostat.

High levels of inactivity, unemployment and underemployment lead to the limited use of human resources (ETF, 2019b, 2019c). On average, almost half of the working-age population are not part of the labour force in the region. Specific groups, such as young people and women, are particularly vulnerable to these trends. Long spells of unemployment, disappointing first work experiences or family care responsibilities lead many youngsters, especially women, into inactivity (see ETF, 2015). In the Southern and Eastern Mediterranean, very low female participation in the labour market is the primary reason for high inactivity. Young people's difficulties in making the transition from school to work are often triggered by poor educational outcomes (e.g. early school leaving or insufficiently relevant skills) as well as by the economic and social context (e.g. low demand, coming from deprived areas, exposure to social risks, or insufficient support given to family carers) (see ETF, 2019c).

As a result, total unemployment levels fluctuate between 10% and 20%, sometimes reaching up to a quarter of the total labour force. Particularly worrying are high youth unemployment rates, with some countries recording a quarter of active young people as unemployed (Egypt, Morocco, Turkey, Algeria, Serbia and Albania) (see Table 2.2). This figure rises to around a third in Georgia, Bosnia and Herzegovina, Tunisia, Armenia and North Macedonia,

and close to a half in Jordan, Palestine and Kosovo. What is more peculiar is the high share of females as well as of tertiary-educated youth among the unemployed groups in Algeria, Egypt, Jordan, Morocco, Palestine and Tunisia.

2.2.3 Higher risk of vulnerability due to poverty and inequality

In spite of some economic improvements in the region, a high number of people experience some type of vulnerability. According to the World Bank development indicators, the poverty headcount ratio at national poverty lines (percentage of population) is gradually decreasing in all countries but is still significant. In the latest year for which statistics are available (2016), around a third of the population was living under the national poverty line in Kyrgyzstan, Tajikistan, Armenia and Egypt, while a quarter of population fell below this line in Lebanon, Palestine, Serbia and Georgia. In Kosovo, Bosnia and Herzegovina, Moldova, Tunisia, Albania, Jordan, Uzbekistan and Russia, the percentage of the population living below the poverty line was around 15%.

Moreover, there are signs of increasing economic inequality and polarisation in all countries. The huge differences in economic opportunities between some regions (e.g. the capital versus the rest of the

Table 2.2. Youth unemployment rates (% from the lowest to the highest), 2019

0–10%		11–20%		21–30%		31–40%		40%+	
KZ	3.7*	UZ	11.6	TJ	20.8	GE	30.4	JO	40.6
IL	6.7	KG	14.8*	MA	22.5*	BA	33.8	PS	40.1
TM	8.3	AZ	12.4	LB	23.3*	TN	34.4	XK	49.4
BY	10.2	RU	15.2	EG	24.7*	MK	35.6		
MD	10.4	UA	15.4	MO	25.2	AM	38.4*		
		EU-28	15.1	TR	25.2				
				DZ	26.9				
				AL	27.2				
				RS	27.5				

Note: * Data for 2018 or 2017.

Source: KIESE based on UIS data (ETF, 2020a), Eurostat and ILOSTAT.

country in most places, or the western and eastern parts of Turkey) and between urban and rural areas within countries (e.g. Georgia, Albania, Armenia and Bosnia and Herzegovina) are well known and well documented. If the Gini coefficient is taken as the measure of inequality, countries such as Turkey, Israel, Russia, Georgia, North Macedonia, Tajikistan, Armenia, and Bosnia and Herzegovina show very high and increasing disparities in the population (World Bank, WDI database). These developments pose a risk to social cohesion and could trigger differing degrees of social unrest and political instability in the affected countries.

One of the results of poverty and inequality is higher labour market vulnerability, as witnessed by the greater incidence of self-employment, sparked by necessity[4], and contributing family workers. This is far from the concept of entrepreneurship which usually involves rapidly growing companies that provide widely desired new products, services or processes[5]. At least half of the country's workforce is self-employed in Albania, Azerbaijan, Georgia, Morocco, Tajikistan, Uzbekistan and Armenia (Table 2.3), and around one-third of the total employed population is self-employed in Algeria, Egypt, Kyrgyzstan, Turkey, Palestine, Tunisia, Kosovo and Serbia. Similarly, the share of vulnerable employment is higher in these countries, which is broadly correlated with the number of own-account and contributing family workers. These are typical examples of the type of lower-productivity employment often observed in the developing world.

Other sources of vulnerability linked to young people's prospects in the region are early school

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Table 2.3. Percentage of self-employed people and those in vulnerable employment (aged 15+), 2019

COUNTRIES	SELF-EMPLOYED	VULNERABLE
Albania	54.3	51.2
Algeria	32.4	NA
Armenia (2017)	40.3	39.1
Azerbaijan	66.6	54.3
Belarus	4.3	3.4
Bosnia and Herzegovina	24.9	19.1
Egypt (2018)	31.4	19.0
Georgia	49.7	47.7
Israel	12.3	9.1
Jordan	15.2	11.0
Kazakhstan (2018)	24.0	22.6
Kosovo	27.1	18.9
Kyrgyzstan (2017)	34.8	33.2
Lebanon	NA	NA
Moldova	22.2	21.8
Montenegro	20.6	13.3
Morocco (2016)	50.5	48.8
North Macedonia	21.1	17.2
Palestine	28.6	22.1
Russia	6.7	5.3
Serbia	27.7	24.3
Tajikistan	42.9	41.8
Tunisia	26.3	19.0
Turkey	31.5	27.1
Turkmenistan	27.1	25.2
Ukraine	16.3	15.0
Uzbekistan	43.4	42.0
EU-28	**15.2**	**10.9**

Notes: Data for Armenia, Belarus and Ukraine is for the 15–70 or 15–75 age group. The Jordanian population is taken into account. The incidence of vulnerable employment is defined by the own-account workers and contributing family workers as a proportion of the total employed in line with the International Conference of Labour Statisticians (ICLS) resolution.

Source: KIESE (ETF, 2020a), Eurostat and ILOSTAT.

Figure 2.5. Percentage of youth not in employment, education or training (NEETs), 2018

■ Total   ● Men   ● Women
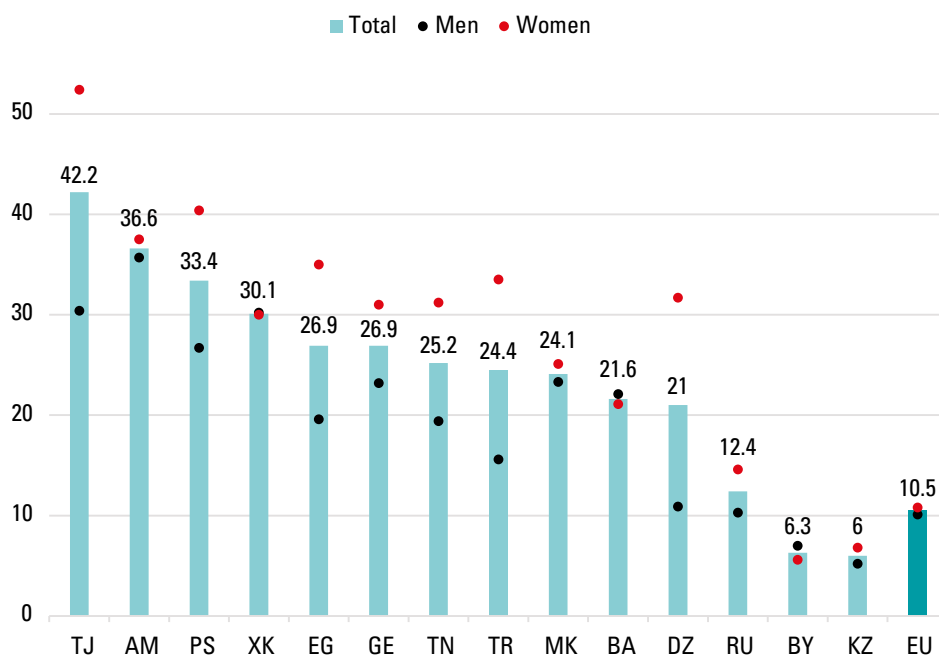
Note: Ranked highest in 2018.

Source: KIESE database (ETF, 2019a), Eurostat and ILOSTAT.

leaving and not being in employment, education or training (so-called NEETs). Early school leaving is often both the reason for and an outcome of poverty and inequality. A high proportion of early school leavers among 18–24-year-olds was observed in Tunisia (37%), Palestine (30%), Armenia (30%), Turkey (29%) and Egypt (28%), while Russia (24%), Moldova (19%) and Albania (16%) also have a relatively high share. By contrast, Belarus, Montenegro, Serbia, Bosnia and Herzegovina, North Macedonia and Georgia seem more successful in keeping their adolescents in school.

The percentage of NEETs among 15–24-year-olds is particularly high in Tajikistan (42%), and accounts for around a third of young people in Armenia, Palestine, Kosovo, Egypt and Jordan (Figure 2.5). One quarter of the youth population are not in employment, education or training in the next group of countries, namely: Georgia, Tunisia, Turkey, Morocco, Albania, North Macedonia, Bosnia and Herzegovina and Algeria. It seems that more females than males become NEETs in most countries, pointing to gender inequality. In the other countries like Belarus, Israel, Kazakhstan, Russia and Ukraine, where the share of NEETs is low, the education and employment systems seem to be relatively more accessible to and effective for young people.

Higher vulnerability also creates emigration flows, especially of young and skilled workers due to

the shortage of decent jobs (ETF, 2019c). All the countries in the region have large migrant stocks living abroad, putting them in the category of sending countries. The EU is the main destination for migrants from Turkey and the Western Balkans, while those from the Eastern Partnership countries go to either Russia or Europe. The EU is also the traditional destination for many migrants from South Mediterranean countries, with some others going to the Gulf region. Besides being emigration countries, many of these states have received significant immigration and refugee flows in the last decade, making them also transit and receiving countries. As a result, the traditional categories of emigrant and immigrant countries have become blurred, especially in the light of the increased South-South migration flows seen in recent years (ETF, 2014). In particular, the arrival of Syrian refugees in Turkey (around 3.6 million), Lebanon (around 1.5 million) and Jordan (around 1.3 million) has led to a significant labour supply shock, with important repercussions for the native workforce (see ETF, 2017a, 2017b).

2.2.4 The potential of technology and innovation to be exploited

Overall, most of the countries under consideration here are recipients of technological advances rather than creators of technology or trendsetters. However, today's technology provides a golden opportunity for emerging and developing economies to grow more rapidly and attain higher levels

of prosperity in a shorter period of time (ADB, 2018). Technology absorption (the acquisition, development, assimilation and utilisation of technological knowledge and capability) and technology diffusion (the process by which new technologies are adopted for use across firms) have important benefits for development and innovation. New technologies diffuse more rapidly where countries are open to international trade and investment, while developing countries have a 'latecomer' advantage, whereby technology diffusion is faster than in developed countries.

There are many studies that show the macro-level growth benefits of increasing broadband penetration, as well as how the lives of individuals and communities are transformed by the arrival of the Internet. It is widely accepted that access to broadband Internet connections raises the propensity of businesses to innovate, and there is a strong link between the expansion of digital connectedness and an economy's productivity and competitiveness (World Bank, 2016). Many countries in the region are catching up with more advanced economies in terms of Internet connection, as seen particularly in the numbers of households with Internet access and individuals who use the Internet daily[6]. These improvements are illustrated in Table 2.4, which gives Internet connection statistics for the four candidate countries and the

EU-28 average. However, the biggest gap between the EU-28 and these countries is the percentage of individuals who ordered goods or services over the Internet. On the other hand, some countries have a very low share of Internet users among the population, for example Turkmenistan (18%), Tajikistan (21%), Kyrgyzstan (35%) and Syria (32%), followed by Algeria (43%) and Uzbekistan (47%) (UNDP, 2018a).

Digital readiness (both in terms of infrastructure and human capital) is vital for taking up the opportunities of the digital economy. A Digital Readiness Index developed by Cisco, ranked countries according to the factors of technology adoption, start-up environment, human capital, technology infrastructure, public/private investment, business foundation, and basic needs (Figure 2.6). Most of the European neighbourhood countries are ranked at the middle stage in this index, except Israel. In particular, Georgia, Russia, Azerbaijan, Kazakhstan, Montenegro, Serbia, Belarus and Turkey show a greater degree of readiness for digitalisation. When this ranking is compared with countries' wealth (GDP per capita), however, we see a relatively high performance in some countries with lower GDP, for example Georgia, Serbia, Montenegro, Armenia. Economic wealth is not the only factor in being ready to embrace the digital economy, other factors such as human capital are important too.

Table 2.4. Internet connection statistics, 2018 (%)

	MONTENEGRO	NORTH MACEDONIA	SERBIA	TURKEY	EU-28
% households with Internet access	72	79	73	84	89
% individuals who use the Internet daily (16–74 years old)	63	68	68	63	76
% individuals who ordered goods or services over the Internet	12	25	35	25	60
% of households with broadband Internet connections	73	78	73	82	86

Source: Eurostat, Digital economy and society statistics – households and individuals.

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[6]   However, a recent survey supported by the World Wide Web Foundation showed that investment in ICT connectivity is seen overwhelmingly as the domain of the mobile operators, which is perceived as 'less good' than broadband Internet connection.

Figure 2.6. Country rankings in the Digital Readiness Index 2019, and GDP per capita (PPP crt. $)
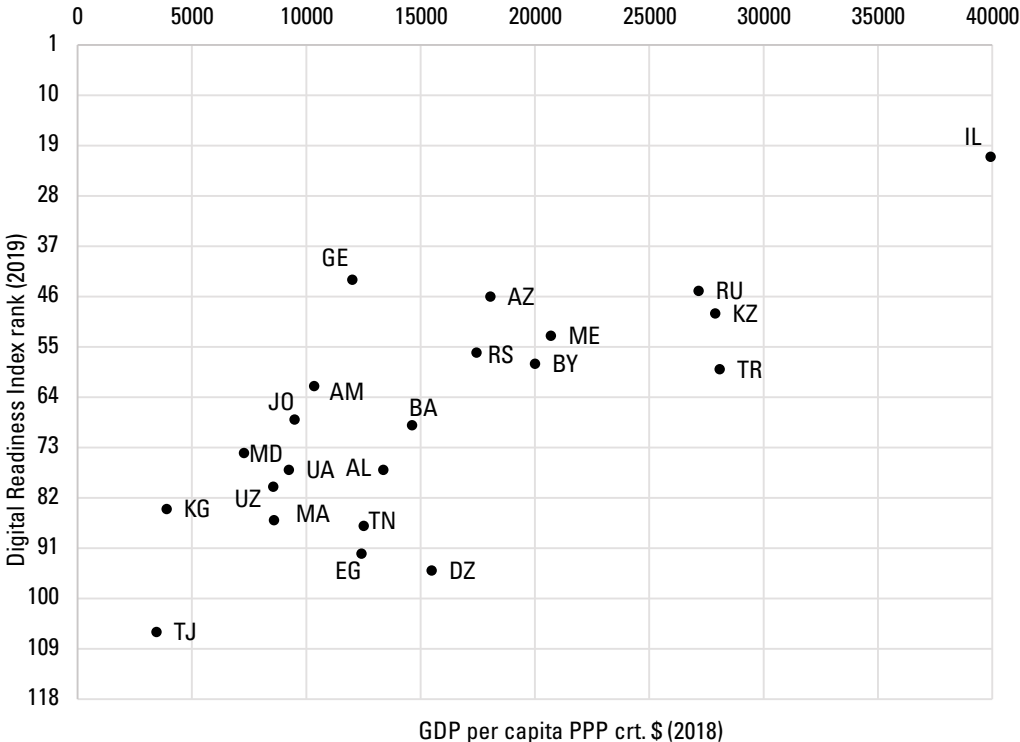
Note: PPP – purchasing power parity, crt – current/nominal $.

Source: For GDP per capita, World Bank WDI database; for Digital Readiness Index 2019, Cisco.

Another vital factor in improving productivity and prosperity is innovative capacity, for example the ability to adopt innovative production processes and create and then commercialise new products. The Global Innovation Index (GII) 2019 provides a detailed measurement of countries' performance in terms of innovation[7]. In addition to the main elements used in the Index, many studies highlight collaboration as innovation's invisible ingredient, since most of the advances in recent decades have come from a few tech hubs, which could combine technical expertise, entrepreneurial thinking and investment capital. The GII 2019 country rankings show most countries of the European Neighbourhood occupying a medium position. Countries such as Russia, Montenegro, Georgia, Ukraine, Turkey, Serbia, Moldova and North Macedonia show relatively higher performance in terms of innovation, while Israel is by far the most innovative.

This ranking gets more interesting when the countries' performance is compared with their level of economic development, as demonstrated by GDP per capita. Although a positive correlation between innovation and economic development is generally visible (e.g. Russia, Turkey), this is not always the case. As Figure 2.7 shows, some countries with much lower income levels (e.g. Georgia, Ukraine and Moldova) can be as innovative as the higher-income countries, and the same is true for Montenegro, Serbia and North Macedonia. On the other hand, some countries with a higher-income status (Algeria, Kazakhstan) are not as innovative as they should be, pointing to other important factors in this area, such as having a high level of human capital.

The innovative capacity of a country is also linked to its research and development (R&D) expenditure (as a percentage of GDP) and its total R&D personnel (as a percentage of total employment). According to World Bank data, Russia (1.11% of GDP), Turkey (0.96%) and Serbia (0.92%) spent a higher share of GDP on R&D in 2018 than the others in the region[8]. By contrast, the average expenditure of the EU-28 countries in 2018 was slightly over 2% of GDP, while in Israel this figure was 4.54%.

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[7] The index measures the innovation input and output in 126 countries. The innovation input captures various elements of innovative activities such as institutions, human capital and research, infrastructure, and the sophistication of markets and businesses. The innovation output captures actual evidence of innovation results such as knowledge and technological and creative outputs.

[8] See World Bank database, https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS

Figure 2.7. Country rankings in the Global Innovation Index 2019, and GDP per capita (PPP crt. $)

Note: PPP – purchasing power parity, crt – current/nominal $.

Source: For GDP per capita, World Bank WDI database; for Global Innovation Index, Cornell University, INSEAD and World Intellectual Property Organisation (WIPO).

The next group of countries, which spent between 0.60% and 0.72% of their GDP are Egypt, Jordan, Morocco, Belarus, Tunisia and Ukraine. The remaining countries spend very little on R&D, varying from 0.30% (Eastern Partnership region, Western Balkans) to 0.10% in Central Asia. The total numbers of R&D personnel and researchers working in all sectors (public, private, higher education, non-profit) is another sign of innovative capacity. Eurostat gives the 2018 figure for R&D personnel as a percentage of total employment (in full-time equivalents) for Serbia (0.77%), Turkey (0.56%), Montenegro (0.30%) and North Macedonia (0.26%)[9]. In the same year the EU-28 average was 1.46%, while Denmark (2.35%) has the highest share of R&D personal in the EU.

2.2.5 Slowly improving the skills pool
As the main element of human resources, the European neighbourhood countries exhibit both different and similar demographic trends. The six countries in the Western Balkans, for example, are characterised by relatively small and declining populations (Figure 2.8). Most of them have a disproportionate share of older people in the population due to low fertility rates and emigration. Similar trends in terms of fertility and emigration are also visible in the six countries of the Eastern Partnership region (ETF, 2019c). Except for Ukraine, these countries also have small populations, and the level of population decline is particularly acute in Ukraine, Moldova and Belarus. Demographic trends in Turkey, with a population bigger than all the above countries put together (except Ukraine), fall between those of the Eastern and Southern Neighbourhood regions.

Contrary to the east, the Arab Mediterranean countries in the south are characterised by booming populations, resulting from a combination of high fertility, falling mortality and increasing longevity. Counted as part of this region, the population of Israel is also increasing. The five countries of Central Asia also have generally young and growing populations. However, no matter the

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[9] See Eurostat database, https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

Figure 2.8. Share of young people (aged 15−24) in the population aged 15−64, 2000, 2010 and 2020

Legend: ■ 2020 ● 2010 ● 2000

Values shown: DZ 21.5, TN 20.3, MD 15.3, MA 24.1, AM 17.3, TK 24.3, AZ 19.1, BY 13.7, KZ 24.8, RU 14.2, TJ 28.9, KG 24.8, UA 14.0, EG 27.5
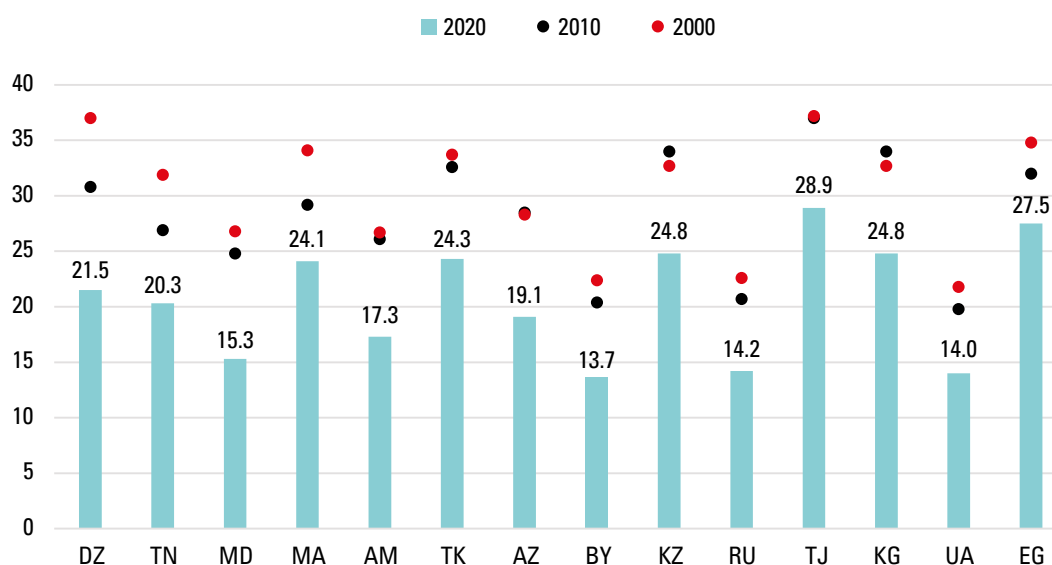
Note: Ranked by the difference between 2000 and 2020.

Source: UN Population Division estimates.

current structure of the population (young or old), all countries are experiencing an increase in life expectancy and a decrease in fertility relative to past trends (Figure 2.8). These tendencies are further accelerated by continuous emigration flows, most of which relate to those of prime working age. As seen in the figure, some countries are ageing more quickly than others (e.g. Moldova, Algeria, Tunisia, Morocco, Armenia, Azerbaijan) (ETF, 2019c).

Skills prove to be a difficult concept to measure[10]. When an overall measure of skill is required, recourse is usually made to educational attainment levels or occupational groups. Both are imperfect measures but they do provide a summary at the national level of the population's educational achievements and qualifications, as well as the types of jobs available in the labour market. As such, they are commonly used measures in statistical analyses of trends in the demand for skills. This article therefore uses educational attainment levels as a proxy for skill levels[11], although it is possible

to have a high-level diploma on paper with low relevance of skills or poor quality of education.

A country's flows and stocks of human capital are vital factors in its preparation for and adaptation to future trends across the board, including labour market performance. Broadly speaking, literacy rates are higher in the Eastern Neighbourhood, where they cover the whole population, compared to the countries in the Southern Neighbourhood. Indeed, illiteracy has not yet been completely eliminated among the 15+ population in a number of countries. In Algeria, Egypt, Morocco and Tunisia illiteracy rates range between 15% to 25% of the population, while lower rates are found in Kosovo, Lebanon and Turkey (UIS database). The mean number of years of schooling is rather low among the population aged 25+ in some countries, for example: 5.5 years in Morocco; 7.2 years in Tunisia; 8 years in Algeria and Turkey; and 8.7 years in Lebanon (UNDP, 2018a). Nevertheless, whatever their starting point, educational attainment levels are generally improving across the board, and the expected years of schooling have reached a minimum of 10 years in all the countries examined here.

In terms of human capital formation, Table 2.5 shows the net enrolment rate (NER) in upper secondary education and the gross enrolment ratio in tertiary education (GER-TER) in the region. Enrolments at both levels have been gradually increasing in all the countries, more substantially at the tertiary level than the upper secondary level. As can be seen in the table, only Jordan has a

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[10] Skills in this context are defined as the ability to apply knowledge and experience to complete tasks and solve problems related to work.

[11] These are categorised as: high-skilled (education level ISCED 5 and above), medium-skilled (ISCED 3 and 4) and low-skilled (ISCED 0–2). On top of this, skills in the 21st century give greater importance to individual reasoning, interpretation and application of knowledge and creativity, with special emphasis on core skills and soft skills (e.g. effective literacy and numeracy, digital skills, foreign languages, learning-to-learn skills, communication skills, problem-solving skills, creativity, personal effectiveness).

Table 2.5. Net enrolment rate in upper secondary education (NER ISCED 3) and gross enrolment ratio in tertiary education (GER-TER), 2019

COUNTRIES	NER ISCED 3	GER-TER
Albania	82.0	59.8
Algeria	NA	51.4*
Armenia	89.5 (NE)	51.5 (NE)
Azerbaijan	99.7 (NE)	31.5 (NE)
Belarus	98.7*	87.4*
Bosnia and Herzegovina	79.0	40.2
Egypt	76.6	35.2 (2017)
Georgia	94.4	63.9
Israel	98.2*	61.5*
Jordan	54.1	34.4*
Kazakhstan	98.9*	61.7
Kosovo	NA	NA
Kyrgyzstan	72.2	42.3
Moldova	64.7 (NE)	39.2 (NE)
Montenegro	89.0	54.2
Morocco	72.1	38.5
North Macedonia	71.1 (2013)	43.1*
Palestine	74.6	43.2
Russia	96.8*	84.6*
Serbia	87.7 (NE)	67.8 (NE)
Tajikistan	NA	31.3 (2017)
Tunisia	NA	31.8
Turkey	83.0*	NA
Turkmenistan	83.0* (NE)	14.2
Ukraine	94.1 (2014)	82.7 (2014)
Uzbekistan	85.7	12.6

Notes: NER is based on the enrolment at ISCED 3 level of the relevant age group in all types of schools and education institutions, including public, private and all other institutions that provide organised educational programmes. GER-TER (ISCED 5–8), regardless of age, is expressed as a percentage of the total population of the five-year age group following on from leaving secondary school. NE – national estimation. * Data for 2018.

Source: UIS database, data extracted on 29 September 2020.

low enrolment at upper secondary education level (54%), while the other countries vary between 72% and 100%. Given the higher enrolment rates in upper secondary education (almost 95% in the EU), more attention needs to be given to the coverage and quality of upper secondary education in many countries, particularly in Jordan, Morocco, Kyrgyzstan, Palestine and Egypt where almost a third to a quarter of youngsters are out of school. The gross enrolment ratio in tertiary education is particularly high in Russia, Belarus and Ukraine, followed by Serbia, Kazakhstan, Georgia, Israel, Albania and Montenegro.

On the other hand, more years of schooling do not necessarily mean better learning. Figure 2.9 compares the expected time spent in school with the learning-adjusted years of schooling[12]. As seen in the figure, there are three-to-five years difference between formal schooling years and actual learning level. In Tunisia and Morocco, for example, learning-adjusted schooling falls from ten years to six, while in Algeria, Egypt and North Macedonia, the gap between learning-adjusted and actual schooling extends to five years.

One important characteristic of education systems is the structure and size of the vocational education and training (VET) element, in particular at ISCED levels 3 and 4. The countries in the European Neighbourhood region are very diverse in this respect. As seen in Figure 2.10, the share of vocational students in upper secondary education is around two-thirds in Bosnia and Herzegovina, Serbia, Montenegro and North Macedonia, and approximately half in Azerbaijan, Kosovo, Israel, Belarus, Russia, Turkey and Kazakhstan. Uzbekistan is an extreme case, with 95% enrolment in VET. On the other hand, the share of VET is around 10% or below in other countries, for example Georgia, Jordan, Palestine, Tajikistan, Tunisia and Morocco. This has significant implications for the labour market performance of secondary education graduates in terms of their adaptability (e.g. general academic education versus vocational education) and sometimes in their continuing to higher education.

[12] Learning-adjusted years of schooling (LAYS) is a methodology developed by the World Bank to combine the quantity and quality of schooling into a single easy-to-understand metric of progress. It is calculated by multiplying the estimates of expected years of school by the ratio of the results from the most recent harmonised test scores, such as the advanced levels of the TIMSS (Trends in International Mathematics and Science Study) and PISA (Programme for International Student Assessment) tests.

Figure 2.9. What matters in schooling: quantity versus quality

■ Expected years of schooling   ● Learning-adjusted years (PISA/TIMSS)

	TN	MA	EG	MK	DZ	RS	KZ	IL	RU
Expected years of schooling	10.2	10.6	11.1	11.2	11.4	13.4	13.3	13.8	13.8
Learning-adjusted years	6.3	6.2	6.3	6.8	6.8	11.1	11.5	11.1	11.9
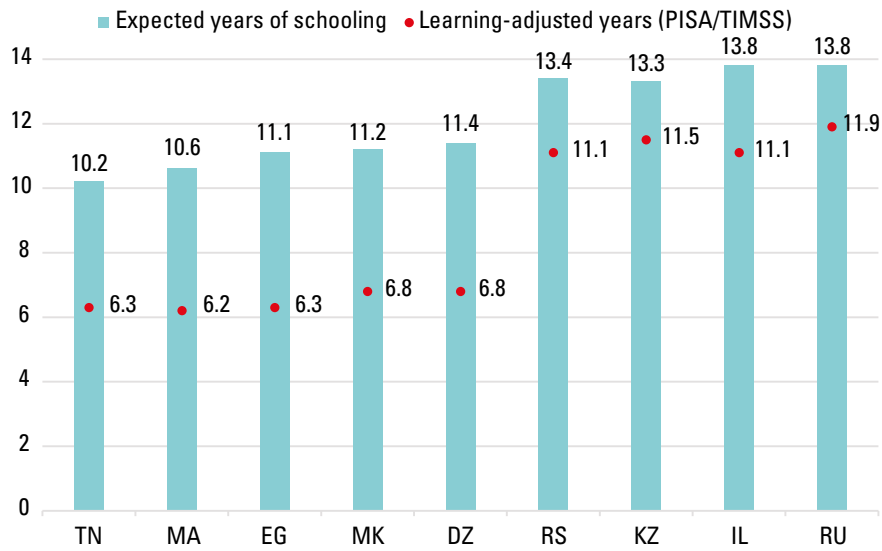
Source: UIS database and World Bank (2018).

Figure 2.10. Percentage of vocational students in upper secondary education (ISCED 3), 2019

Country	Value
PL	3
TJ*	6.4
TN*	9.6
JO	10.7
GE	11.2
MA	16
AL	18.2
TM*	21.7
AM	25.9
LB	26.2
UA	28.6
KZ	34.5
IL*	40.8
KA	41.6
BY	41.7
MD	45.7
TR*	46
AZ	47.2
EG	47.3
EU28	48.4
RU*	50.7
XK*	52.9
MK*	59.9
ME	68.2
RS	73.8
BA	77.2
UZ	95.1
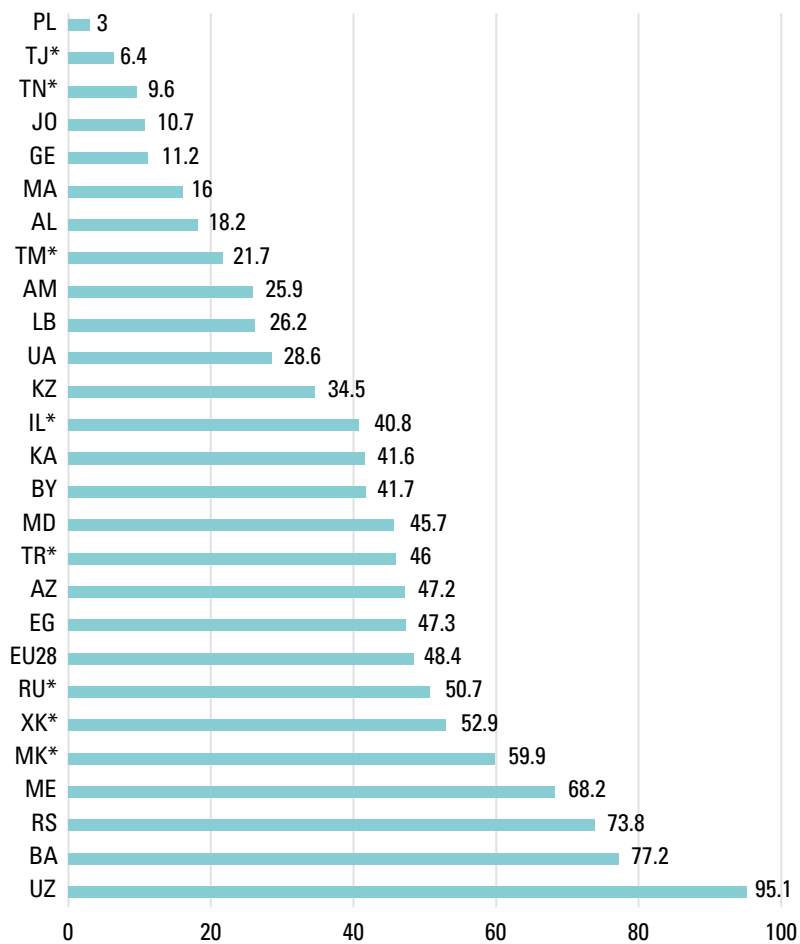
Note: * Data from 2018 or before.

Source: KIESE (ETF, 2020a), based on UIS and Eurostat.

2.3 How are countries affected by the global drivers of change?

As mentioned before, many broad trends of change can be observed in labour markets at the global level. These are the destruction of some jobs due to automation; the changing task content of existing occupations; the polarising of occupational structures; the emergence of new jobs; the stratification or segmentation of 'knowledge work'; changes in employment patterns (increasing non-standard forms of employment); and the erosion of standard employment benefits (see Article 1 for a thorough analysis).

This section looks at changes such as these in the region and gives examples of transformations from different countries. Although most of the countries under consideration are recipients of technological advances rather than creators of technology, similar trends can be observed to varying degrees. Special attention is given to increasing participation in global value chains; sectorial shifts in countries' economies; automation and the use of robots; newly emerging sectors or cross-cutting trends; the expansion of platform work; and changes in employment patterns and occupational structures.

2.3.1 Increasing participation in global value chains
Recent decades have seen several low- and middle-income countries become an integral part of global value chains (GVCs), which has contributed to higher productivity and faster growth through catching up industrialisation[13]. According to the World Trade Organisation (WTO, 2019), GVCs are a channel for attracting FDI, transferring new technologies, and passing knowledge and know-how from developed to developing countries – with spill-over effects in terms of jobs and wages, sectors of employment, and skills and learning. It is true that developing economies tend to be positioned more downstream in the value chain (e.g. with a high share of final goods exports), while advanced economies are typically positioned more upstream (Kummritz

and Quast, 2017), but some developing countries seem to succeed, first 'engaging' in GVCs, then 'upgrading' along GVCs, using them as a way of 'leapfrogging' and 'competing' (OECD, 2013).

The best development outcomes result from increasing GVC participation and upgrading along GVCs at the same time, although the gains from this type of trade are not distributed equally within and across countries[14]. In countries that participate in GVCs, job and wage gains are achieved not only within the exporting sector, but indirectly through linking exporting firms to domestic, input-supplying companies (WTO, 2019). As a result, demand for skilled labour rises in developing countries. The skill-biased nature of GVC trade is also associated with the increased complexity of global supply chains as well as the greater use of skill-intensive inputs, notably services (OECD, 2013). The main enabling factors of GVC participation are larger market size, higher development levels (GDP per capita), a greater share of manufacturing, and proximity to large 'headquarter' economies – for example the main manufacturing hubs in Europe, North America and Asia (OECD, 2015)[15].

The neighbouring countries around the EU are on the economic periphery of Europe, with strong connections to the EU as the 'economic centre' via trade in goods and services, FDI and labour migration. The EU, indeed, has been the key trading partner for most Neighbourhood countries. These relationships have been further strengthened by special agreements signed between the EU and neighbouring countries under the framework of the EU's European Neighbourhood Policy[16]. One of main aims of the bilateral association agreements signed between the EU and its neighbours is establishing economic cooperation and free trade. All countries in the European neighbourhood have association agreements with the EU (except Syria, Libya and

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13 As GVC activities are spread across multiple countries, both large and small companies can participate in GVCs by engaging in one of the many types of activities performed in a coordinated fashion across a number of countries to bring a product from conception to end use. These activities might include farming, the extraction of natural resources, research and development, different types of manufacturing, design, management, marketing, distribution, post-sale services, and many others. Participating in GVCs does not necessarily mean directly trading goods or services across borders, but rather being linked to such activities through the process of value creation.

14 The distribution of added value along global or regional value chains has not been uniform. East and South-East Asia (e.g. China, Hong Kong, Singapore, Taiwan, South Korea, Vietnam and Bangladesh) remains the region with the highest level of GVC participation, reflecting its primacy in terms of export-oriented manufacturing and processing activities.

15 Other important factors that also shape the offshoring decisions of lead firms are business environment and trade policy, openness to FDI, intellectual property protection, logistics and transport infrastructure, quality of institutions, labour costs and skills levels.

16 The European Neighbourhood Policy foresees the signature of bilateral association agreements or stabilisation and association agreements with the neighbouring countries surrounding the EU, including political, economic and social pillars. It also supports two inter-regional cooperation initiatives: the Eastern Partnership (EaP) and the Union for the Mediterranean.

Belarus). Moreover, the association agreements signed with Georgia, Moldova and Ukraine included the creation of a deep and comprehensive free trade area for deeper economic integration. As a result of their special relationship, Turkey has had both an association agreement and a Customs Union with the EU since 1996.

The EU enlargement process is further deepening economic integration in the Western Balkans and Turkey. Association agreements with the Western Balkan countries are called 'stabilisation and association agreements' and aim to achieve economic integration and eventual EU membership. Since 2017, the Western Balkan countries have decided to develop a regional economic area where goods, services, investments and skilled workers can move freely. As a result, an action plan was adopted to drive the regional economic growth (with 20 million consumers), mainly focusing on digital integration, mobility, trade and investment, and taking advantage of trade relations with the EU[17]. If these countries can carry out comprehensive economic structuring and attract higher inflows of FDI, together with the transfer of technology, know-how and managerial skills, they can reach higher levels of productivity and reduce the wealth gap between themselves and Europe in the longer term. This has been precisely the case for the new EU Member States that acceded to the EU in 2004 and 2007. The IMF compared the economic performance of the Western Balkans with that of the Central and Eastern European countries which became new EU members, and concluded that the delayed transition process in the Western Balkans was risking the region's permanent marginalisation on the periphery of Europe (IMF, 2014).

Within this context, GVCs in this region are mainly organised around Europe's large manufacturing hubs. Israel, Russia, Turkey, Egypt, Morocco and Tunisia show higher levels of participation in GVCs. Sectors with greater GVC involvement are agriculture, agri-food, plastics and rubber, textiles, metal products, electrical and electronic equipment, chemicals and motor vehicles. With the primary advantage of being close to Europe, Turkey participates in the GVCs for textiles,

machinery, chemicals, metals, electrical products, electronics and motor vehicles. According to the OECD, however, Turkey's export business is still concentrated on final rather than intermediate goods, and its engagement in GVCs remains below its potential due to a number of factors: institutional features that hamper the efficient allocation of capital and labour; low levels of human capital; and insufficient investment in innovation, research and development (OECD, 2016). One success story that provides an example of deepening GVC integration over time is the Turkish automotive sector, which increasingly produces car components rather than merely assembling cars, leading to a greater demand for skilled labour and the emergence of a number of new skills in the sector (see ETF, 2020c).

Tunisia participates in GVCs with respect to textiles, electrical machinery, transport equipment and motor vehicles, aeronautics, home appliances, food products and chemicals, usually producing labour-intensive, low-end products (Bass, 2016). But thanks to its close links to the European GVC hub, it is moving up the value chain and deepening its level of integration (OECD, 2015). The same also applies to Morocco, which is showing and an increased involvement in GVCs for phosphate and chemical derivatives, textiles and apparel, agriculture, electrical machinery, coke & petroleum, motor vehicles and tourism services (OECD, 2018). Egypt's textiles sector is engaged in the full range of GVCs – from cotton cultivation to the production of fabrics and ready-to-wear clothing – thus creating about 30% of manufacturing job opportunities (UNECA, 2016). In addition to textiles, metals, chemicals and agri-food, Egypt is also part of the ICT value chain that spans the entire GVC, from new product development to providing technical solutions to global clients from state-of-the-art call centres (UNECA, 2016). Proximity to Europe seems to be a primary advantage for the region in participating in GVCs and international trade, as well as in attracting FDIs.

As a result, many economies of the region are highly open to and dependent on international trade. According to the World Bank's calculations of imports and exports as a percentage of GDP, the most open economies of the region are Belarus, North Macedonia, Georgia, Serbia, Montenegro, Bosnia and Herzegovina, Ukraine and Kyrgyzstan, where exports and imports together reach or exceed the total GDP (Figure 2.11). For a comparison, the EU-28 has 91% of its GDP coming from exports and imports. Other countries with open economies are Armenia, Jordan, Morocco, Moldova, Kosovo and Albania, but overall, most countries have a high share of trade in their total GDP.

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[17] A regional economic area is not an alternative to EU integration; the progressive deepening of the economic integration in the region is based on EU rules and principles. Such an approach secures integration within both the region and the EU. In this way, this initiative is an important milestone for preparation for EU accession, which is reflected in the recent strategic documents issued by the European Commission. For more info, see: Western Balkans: Regional Economic Area, Multi-annual Action Plan for a Regional Economic Area in the Western Balkans

Figure 2.11. Openness of the economies: imports and exports as % of GDP, 2019 or latest available year
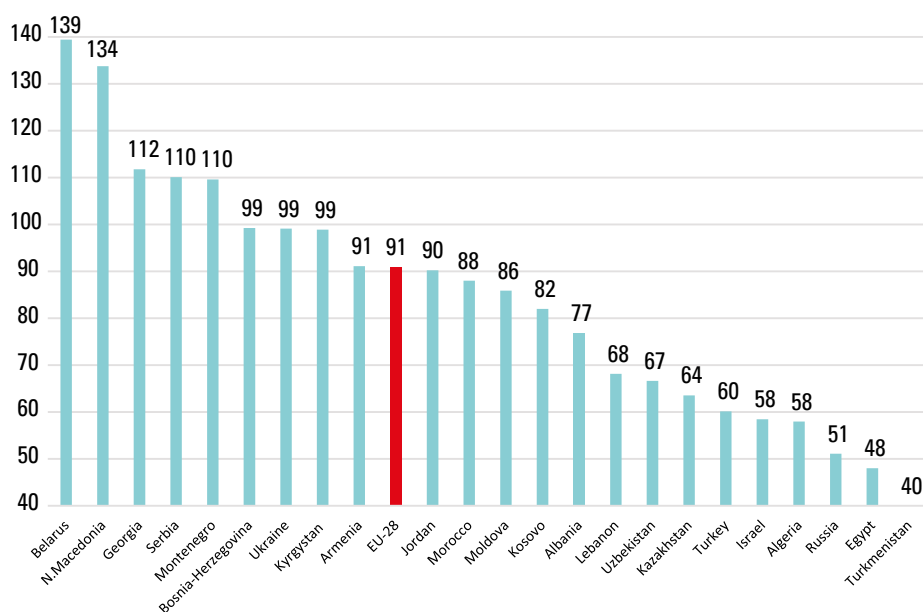
Note: The openness of the economies is measured by summing up imports and exports as a percentage of GDP based on national accounts data.

Source: World Bank database https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS

2.3.2 Sectoral shifts in the economies of region

The GDP and employment shares of broad economic sectors indicate countries' economic development stage. As in other parts of the world, the countries of the European Neighbourhood region are also experiencing gradual but continuous sectoral shifts in their economies. The main trends observed in almost all countries are an ever-increasing service sector, a relatively static industrial sector and a continuously decreasing agricultural sector. As readers will remember from Section 2.2, the service sector already dominates the employment of the workforce in all countries neighbouring Europe, occupying a share of total employment ranging from 45% to 80%.

Figure 2.12 shows the continuous increase of employment in the service sector between 2000 and 2019 in almost all countries. The growth of the service sector has varied from eight to 18 percentage points across the countries over the last two decades. Still, some countries have a relatively small share of services, – such as Tajikistan, Turkmenistan and Uzbekistan, as well as Morocco, Albania and Georgia – which can be largely explained by the high share of agricultural employment in these countries. While services are generating more employment in all the countries, their output, however, is not necessarily increasing. A review of the changes in gross value added of services (percentage of GDP) between 2010 and 2019 shows a stagnation of outputs (Moldova,

Serbia, Israel, Bosnia and Herzegovina), if not a decrease (Ukraine, Georgia, Tajikistan, Uzbekistan)[18]. In other countries a very modest increase of outputs is observed (mostly by 1–2 percentage points), with few exceptions where the increase has exceeded 5 percentage points (Azerbaijan, Armenia, Algeria, Belarus). This means a low productivity of these new jobs and decreasing wages in the sector.

As mentioned before, the agricultural sector is the source of around or above one-third of total employment in a number of countries. But regardless of each country's starting point, a continuous decline in agricultural employment is another very visible trend across the board (Figure 2.13). When we look at the evolution of agricultural employment between 2000 and 2019, the sharpest falls are observed in Kyrgyzstan, Kazakhstan, Tajikistan, Albania, Moldova, Turkey, Algeria and Morocco. This trend means that workers leaving agriculture need to adapt to the new sectors (mostly services), requiring reskilling and upskilling. While agricultural jobs are disappearing in all the countries, their output also stagnated or decreased – e.g. according to the World Bank database, two-thirds of countries in the European Neighbourhood region experienced a decrease (by 1–5%) or stagnation in their gross value added of

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[18] Based on data from the World Bank WDI database (last accessed 16 September 2020).

Figure 2.12. Employment in services (% of total employment), 2000–19
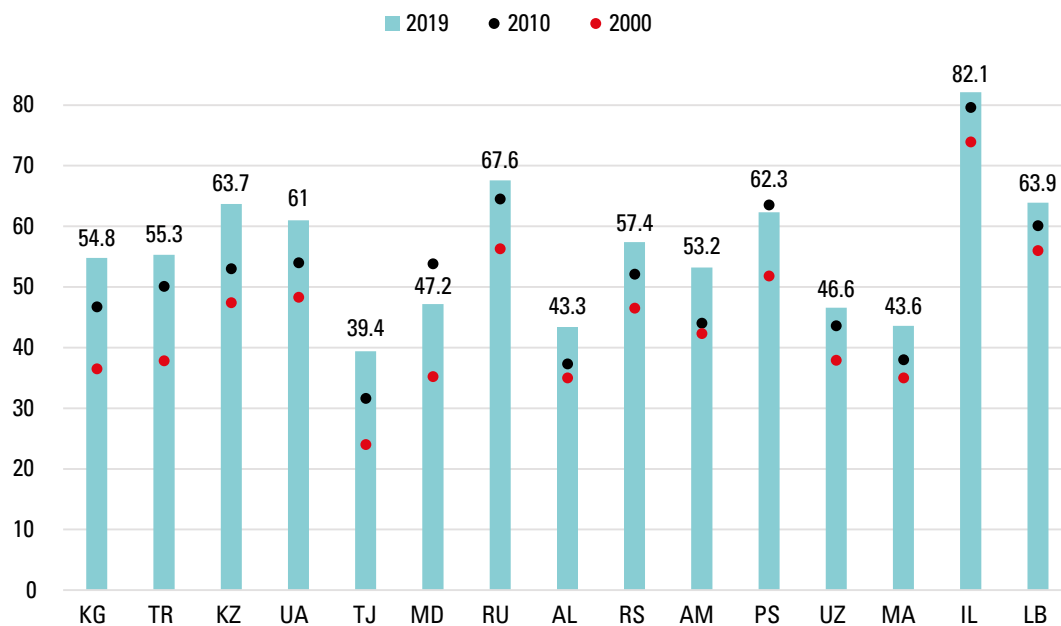
Note: Countries ranked by the difference between 2000 and 2019.

Source: ILOSTAT.

Figure 2.13. Employment in agriculture (% of total employment), 2000–19
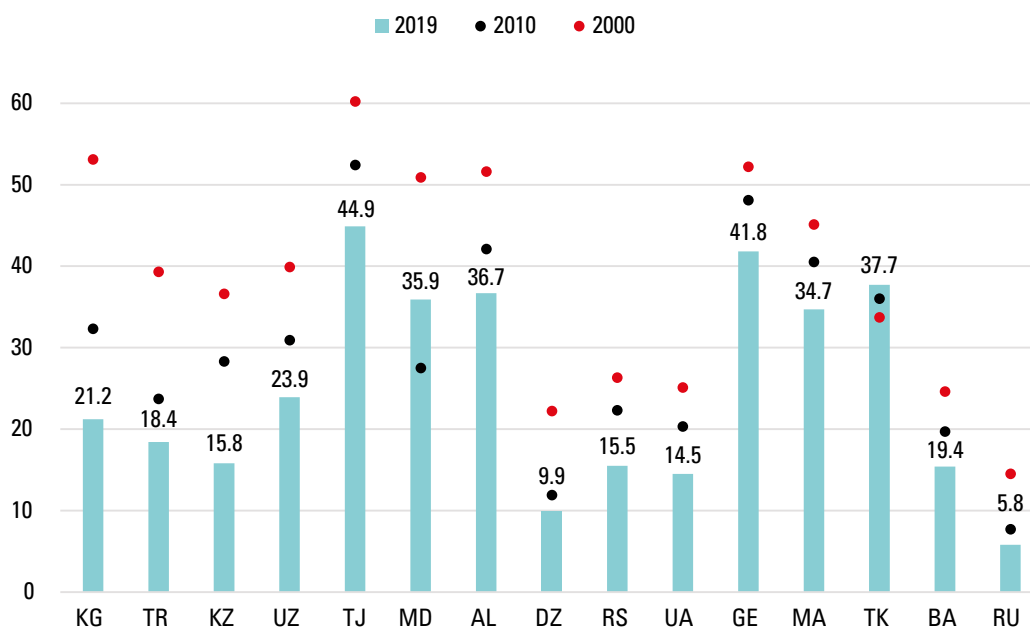
Note: Countries ranked by the difference between 2000 and 2019.

Source: ILOSTAT.

agriculture between 2010 and 2019[19]. Only a handful of countries recorded a small increase of agricultural outputs (Algeria, Lebanon, Tunisia and Tajikistan).

In contrast to agriculture, employment in industry (including manufacturing and construction) is relatively small (ranging between 15% and 25% of total employment). Moreover, the share of those employed in this sector has been generally static in most countries – with only small rises or falls (few percentage points) observed over the last two decades (Figure 2.14). However, we can see an increase in industrial employment of up to five percentage points in countries whose formerly large agricultural sector is now shrinking (e.g. Albania, Algeria, Egypt, Kyrgyzstan, Turkmenistan, Uzbekistan and Kazakhstan). Considering the decline in agriculture in these countries, this trend can be interpreted as reflecting a structural change in those economies, signalling a transition from primary activities towards light manufacturing (including agri-food, agri-business, construction, textiles, etc.). In terms of industrial output, however,

there was no visible increase in gross value added between 2010 and 2019 in the region; it mostly stagnated at the same level or even decreased[20]. The only countries that recorded a small increase of their industrial output were Georgia, Kosovo, Moldova, Turkey, Russia and Uzbekistan. As a result, many of these countries are likely to depend on improved and enlarged traditional sectors in the future – albeit to differing degrees.

Thus, the winner in terms of the economic shifts taking place in the region is the service sector, as is the case everywhere in the world, although the share of high-end services (financial services, health, education and ICT) tends to be relatively low, while the share of low-end services (hospitality, wholesale and retail trade, real estate and renting, personal services) is generally higher. This means that more jobs will be created in the service sector, and workers will need to adjust their skill sets to fit this evolution, with more emphasis on cultivating socio-emotional skills, key competences and soft skills.

Figure 2.14. Employment in industry (% of total employment), 2000–19
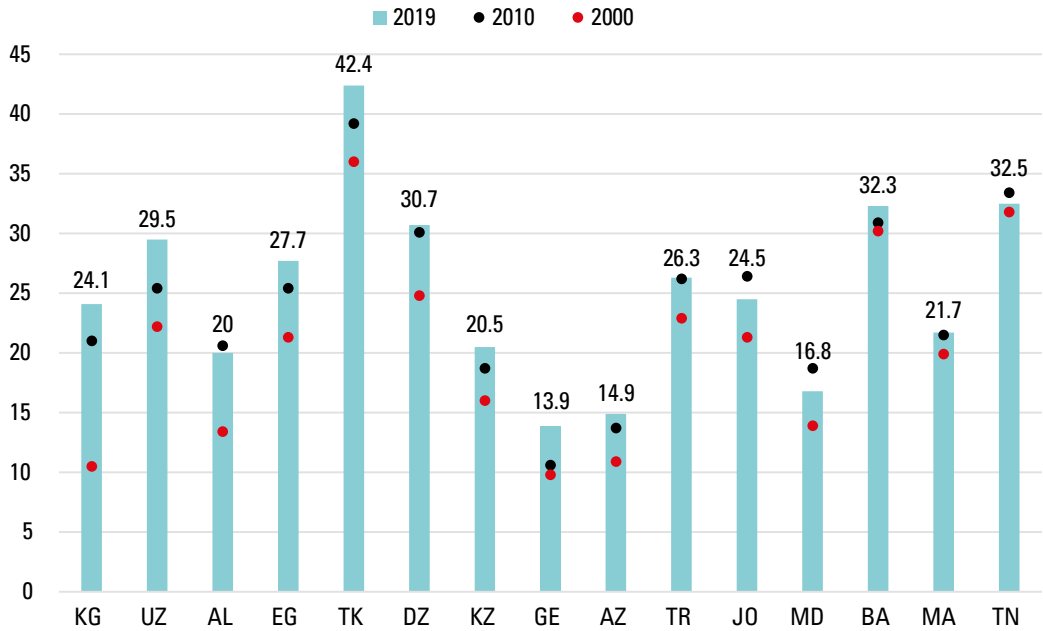
Note: Industry includes both manufacturing and construction. Countries ranked by the difference between 2000 and 2019.

Source: ILOSTAT.

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[19]   Based on data from the World Bank WDI database (last accessed 16 September 2020).

[20]   Ibid.

2.3.3 Early signs of automation and the use of robots

In principle, automation trends affect developing countries in two ways: decreasing offshoring due to the development of automation in high-income countries; and countries installing automated systems for themselves. First, automation may reduce the need to relocate production from advanced to developing countries (so-called reshoring/onshoring or deglobalisation). Second, as observed elsewhere, economies' industrial sectors – even if small and mostly concerned with light manufacturing – are also susceptible to automation. According to McKinsey (2017), the percentage of work activities that could be automated by adapting the current technology is 50.5% in Morocco, 50.4% in Turkey, 50.3% in Russia, and 48.7% in Egypt. For examples of other emerging economies, the World Bank (2016) calculated that the risk of automation could affect up to 69% of jobs in India, 77% in China, and 56% in Albania. Higher levels of automation are also expected in Central and Eastern Europe, which had benefited greatly from the earlier wave of technological change through capital inflows and integration into global value chains (mainly as a result of their accession to the EU) (ADB, 2018).

Controversial views exist about the impact of automation in low- and medium-income countries. According to *The Economist* (2018), for example, low-income and predominantly agricultural economies will be largely unaffected by automation in the short term, while middle-income countries will be widely affected. The latter will find adapting to automation hard if they do not have a strong education base (with an average attainment of upper secondary level). *The Economist* ranked Turkey and Russia 15th and 16th respectively out of 25 countries in its automation readiness index. On the other hand, McKinsey (2017) argues that routine agricultural work is also highly susceptible to automation, meaning that countries with a large agricultural sector experience the continuous exit of workers from this sector, who then flood into the service sector, driving down earnings, inflating service-sector employment and causing wage stagnation. The predicted result will be slow real-wage growth in low-skilled jobs in low-end services as workers face competition from automation. However, automation could increase productivity as well as wages in relevant sectors for some medium- and high-skilled workers, given that the supply of skilled labour capable of interacting with automated processes is not that high in the region.

One of the key elements in automation is the robot density level in manufacturing – measured as the number of industrial robots per 10 000 employees[21]. According to the International Federation of Robotics (2020a), currently more than 2.7 million industrial robots are used in the world, with 73% of them installed in five countries (China, Japan, the USA, Korea and Germany). The most widely used applications for industrial robots are handling and welding, followed by assembling, cleanrooms, dispensing and processing. The demand for industrial robots has risen considerably since 2010 and annual installations increased by 11% on average each year from 2014 to 2019, a phenomenon which also involved some neighbouring countries. Thus, robot density in the manufacturing sector varies greatly between countries, from 918 (per 10 000 employees) in Singapore and 346 in Germany to 89 in the UK and 44 in Mexico[22]. Out of the countries in our region, Israel (49), Turkey (29) and Russia (6) made it onto this list.

Table 2.6 shows the stock of industrial robots in selected countries, including many in the Neighbourhood region. Turkey occupies the 20th position in terms of industrial robots used, with a stock of over 15 000 in 2019, and an annual increase of 19% from 2014 (IFR, 2020a). The list also includes Russia (32nd place with over 6 000) and Israel (with almost 2 000 robots in use). Even Morocco had 746 robots in 2019, experiencing a 42% annual increase in robot installations. It can thus be seen that the use of industrial robots is also spreading in the region, especially in countries with a significant manufacturing sector, such as Belarus, Ukraine, Egypt, Tunisia, Morocco, Serbia, Bosnia and Herzegovina and Moldova. This trend further requires adaptations in terms of labour market demand, with an increasing supply of candidates with cognitive, digital and STEM skills.

The automotive industry is the most important customer for industrial robots. It uses 34% of all industrial robots installed in the world, ahead of

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[21] According to the International Federation of Robotics, an industrial robot is defined as an automatically controlled, reprogrammable, multi-purpose manipulator programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications (IFR, 2020a).

[22] The full list of examples of robot density in the manufacturing sector is: Singapore (918), Korea (855), Japan (364), Germany (346), Sweden (277), Denmark (243), Hong Kong (242), the USA (228), Italy (212), the Netherlands (194), Spain (191), China (187), France (177), Slovakia (169), the Czech Republic (147), the UK (89), Israel (49), Poland (46), Mexico (44), Turkey (29) and Russia (6) (IFR, 2020a).

Table 2.6. Operational stock of industrial robots at year-end in selected regions, 2014–19

COUNTRIES	2014	2015	2016	2017	2018	2019	2014–19
Germany (5th)	175 768	182 632	189 305	200 497	215 795	221 547	+5%
Czechia (16th)	9 543	11 238	13 049	15 429	17 603	19 391	+15%
Poland (18th)	6 401	8 136	9 693	11 360	13 632	15 769	+20%
Turkey (20th)	6 286	7 940	9 756	11 599	13 498	15 022	+19%
Slovakia (29th)	3 891	4 378	6 071	7 093	7 796	8 326	+16%
Russia (32nd)	2 694	3 032	3 366	4 028	4 994	6 185	+18%
Israel	938	1 080	1 278	1 533	1 770	1 979	+16%
Belarus	140	145	150	161	168	192	+7%
Ukraine	100	101	96	108	175	198	+15%
Egypt	112	143	167	188	253	295	+21%
Tunisia	141	155	158	180	199	242	+11%
Morocco	128	142	173	230	536	746	+42%
Serbia	42	65	93	123	177	246	+42%
Bosnia and Herzegovina	7	9	19	25	28	30	+34%
Moldova	5	5	5	5	5	5	–
Uzbekistan	4	4	4	–	2	2	–13%

Source: IFR (2020a).

the electrical/electronics industry (25%)[23]. Other sectors using robots are metal and machinery (12%), plastics and chemical products (5%) and food and beverages (3%). According to the International Federation of Robotics (IFR, 2020a), Turkey has become a promising emerging market for robot installations as it is an important production site for cars and commercial vehicles. Its economy, particularly the automotive sector, is well integrated in European supply chains and is thus affected by the trends governing the major economies. Indeed, 42% of all robot installations in Turkey are in the automotive sector, followed by the metal industries (16%), the plastics and chemical industry (11%), the electrical/electronics sector (4%), food and beverages (5%), and others (23%).

Similarly, significant shares of robots are used in the automotive sectors in Russia, Morocco, Tunisia and Serbia.

Robot technology is also used in non-manufacturing applications such as agriculture, logistics, construction, medicine, entertainment, defence, transportation and maintenance, among others. Robots that perform useful tasks for humans, excluding industrial automation applications, are called 'service robots'. They are classified as professional service robots (used for commercial tasks, usually operated by trained operators)[24] and

[23] The electrical/electronics industry includes computers and computing equipment, radio, TV and communication devices, medical equipment, and precision and optical instruments.

[24] Examples of professional service robots include field robots used in agriculture, mining and space robots; professional cleaning robots for floors, doors, tank, tubes and pipe cleaning, hull cleaning; construction robots for nuclear demolition, building construction, heavy/ civil construction; autonomous guided vehicles (AGVs) in indoor and outdoor logistics, personal transportation (AGVs for people), other robots in logistics; powered

personal service robots (used for non-commercial tasks, usually by lay persons)[25], encompassing a broad field of applications compared to industrial robotics, from full teleoperation to fully autonomous operation. The sector is experiencing strong global growth and market demand has even increased as a result of the Covid-19 pandemic – for example cleaning and disinfection robots, transport/delivery robots, floor-cleaning robots, robo-mowers and robots for edutainment and interaction (IFR, 2020b). Besides Covid-19, the lack of skilled workers in several professions, demographic changes or sustainability requirements have also contributed to this growth.

According to the International Federation of Robotics (IFR, 2020b), the top three applications for professional service robots are logistic robots (43% of total sales), robots for public environments (e.g. mobile guidance, information kiosks, telepresence robots, hotel, restaurant and bartender robots in hospitality), and defence applications (15% of total sales)[26]. Another important segment is agriculture, dairy and livestock farming. While the use of robots in livestock farming has been quite widespread, agricultural applications like fruit picking constitute a challenge for robotics, both technologically and because of the relatively low costs of human labour. The Covid-19 pandemic might change this as travel bans are causing a shortage of (immigrant) labour in the harvesting seasons. The top three applications of personal service robots are related to domestic tasks and entertainment. Overall, 18.6 million units of domestic/personal robots were sold in 2019 (+40% from 2018), 4.6 million of which were entertainment robots. Who would not want a robot at home taking care of tedious everyday tasks such as floor cleaning, watering flowers, laying the table, or cleaning the kitchen?

All these developments in service robotics imply tremendous changes in terms of agricultural and service sector jobs, including in the European Neighbourhood region. These countries are already important customers for such robotic products, while the use of service robots is accelerating in the region, given the huge number of potential customers and users. This trend has already been spotted in a study from Turkey. Sumer (2018) found that a significant share of jobs in clerical occupations, as well as those tasks performed by service and sales workers, plant and machine operators and assemblers, are highly susceptible to automation. Although this transition will not occur overnight, it will become more likely as the costs of such robots decrease. It should be emphasised that the production of service robots is concentrated in the main manufacturing hubs in Europe, North America and Asia, and not many are produced in the neighbourhood region[27]. Given the sector's promising future, this may be a missed opportunity. However, Russia is already producing a high number of service robots (with 73 companies), and there are currently 13 companies in Israel and three in Turkey (IFR, 2020b).

2.3.4 Newly emerging sectors and/or cross-cutting trends

Once high-speed Internet connections are accessible and affordable for a 'skilled workforce', there are many opportunities for countries to catch up and create value in the digital economy in areas such as skills-intensive investments, automation in agriculture (precision farming), or rapid success in e-business, among others. In general, the digital economy helps to increase the share of services in domestic and international trade. One example is e-commerce; although its level is low, it shows very high yearly growth in the European Neighbourhood countries, representing an untapped market to conquer. In the Middle East and the Gulf, some countries like Egypt, the United Arab Emirates and Saudi Arabia are already experimenting in significant innovations and could become part of one the fastest growing e-commerce markets in the world. For example, Noon.com is a Saudi Arabia

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exoskeletons (i.e. wearable robots, handling aids, etc.); medical robots for diagnostic systems, robot-assisted surgery or therapy, rehabilitation systems; fire- and disaster-fighting robots, surveillance/security robots for rescue/security; defence robots such as de-mining robots, unmanned aerial vehicles, autonomous ships (IFR, 2020b).

[25] Examples of domestic/personal robots are those for vacuuming, floor cleaning, lawn mowing, pool cleaning, window cleaning, home security and surveillance, domestic servant robots, entertainment robots (toy/hobby robots, multimedia and social, education and research) and robots providing elderly and handicapped assistance (robotised wheelchairs, personal aids and assistive devices, etc.) (IFR, 2020b).

[26] In 2019 almost 75 000 logistic robots were sold (+42% from 2018), 20 000 public robots (+44%) and nearly 19 000 for defence applications. About 8 200 (+1%) milking robots and robots for livestock farming were sold, and around 1 600 robots (+48%) for other agricultural uses. Similarly, approximately 5 000 surgery robots (+25%) and more than 3 600 rehabilitation robots (+45%) were sold in 2019 (IFR 2020b).

[27] According to the IFR (2020b), in 2019 there were a total of 889 service robot suppliers. The United States is the home of most service robot suppliers (223 companies), while Russia has 73 companies for service robots. This is followed by Germany (69), China (64), France (52), Japan (50), the United Kingdom (39), Switzerland (34), Canada (33) South Korea (33) and Italy (30). In general, in that year 55% of professional service robots came from Europe, 34% came from North America and 11% came from Asia. In contrast, 66% of the personal/domestic service robots originated in North America, 24% in Asia, and 10% in Europe (IFR, 2020b).

competitor of Alibaba and Amazon, while Souq.com is the market leader in the Middle East, sometimes likened to a regional Amazon.

Etsy is another type of e-commerce, a global marketplace for unique and creative goods, from handmade or vintage pieces and supplies to unique factory-manufactured items. The site follows in the tradition of open craft fairs, charging sellers a fee for personal storefronts where they show their goods. As of December 2019, the Etsy marketplace connected 2.7 million active sellers with 46.4 million active buyers located internationally. It has enabled small business owners around the world to stay open through the Covid-19 pandemic, creating a virtual Main Street of 2.7 million shop owners. At least 20 of the European Neighbourhood countries have been selling artisan crafts in this marketplace[28].

Another example is the legalisation of Uber and its competitor Careem in Egypt in May 2018. With only two years' experience, Egypt is currently one of Uber's fastest growing markets worldwide. There are more than 40 000 Egyptian drivers working on the platform every month, and new drivers are joining up at the rate of 2 000 a week. 'What's very different in Egypt compared to anywhere else is the economic opportunity that Uber provides to drivers' (quoted in Lane, 2017). Forty per cent of Uber drivers were unemployed before joining Uber, making it a valuable additional source of income, especially given the difficult times the country is going through. There are even increasing numbers of women drivers who are specifically asked for by female clients. A similar story is found in Serbia, with a Serbian platform-based start-up providing ride-hailing services called 'Car:Go'.

A final example is Safe Boda in Uganda – a local start-up that filled a gap by organising motorcycle taxis in the capital Kampala[29]. An online app was launched for matching drivers with clients (beyond the personal network of word of mouth), expanding the customer base for the drivers and providing a real-time traceability for the clients, with payment by mobile money. Given the negative reputation of unregulated motorcycle taxi drivers, the company provided helmets for drivers and customers, technical training for drivers, safety and client relations training, and traceability by providing individual numbers. This is in a context where the informal economy is paramount in virtually all sectors, not least in the transport sector, and which lacks a functioning public transportation system.

As opposed to the negative perception of Uber in other labour markets, the same disruptive approach allowed for upgrading (and formalising) the informal economy of the motorcycle taxis in Uganda.

Besides Internet-based business opportunities, the ICT sector itself provides many new opportunities. Technological convergence between telecommunications (especially mobile phones), broadcasting/social media and IT has raised the profile of the ICT sector, which has a growing importance in the broader economy and employment of the region. It must be noted that the location of the ICT sector has long since shifted from advanced economies towards emerging countries, and ICT employment in developing or emerging economies has grown very rapidly (Delautre, 2017). In particular, the ICT services sector is highly dynamic, representing 73% of the total value added of the ICT sector globally. Local knowledge (for instance, of search habits, traffic conditions and cultural nuances) gives an advantage to locally rooted digital platforms, enabling them to offer services tailored to local users – a benefit that is equally applicable in the European neighbourhood region. Boosting entrepreneurship in digital and digitally enabled sectors is therefore key to local value creation. The countries of the region, however, barely rank among the first 50 countries in the Digital Entrepreneurship Index in 2020[30].

Following global trends of digitalisation as a political goal (e.g. the EU Digital Agenda), the European neighbourhood countries have also developed actions to promote growth and innovation in the ICT sector, often supported by the EU. For example, in the Western Balkans Strategy adopted by the EU in 2018, one of the six flagship initiatives is the new Digital Agenda for the Western Balkans. Similarly, EU cooperation with the Eastern Partnership (EaP) countries includes sharing experiences of the EU's Digital Single Market and supporting the implementation of the EU4Digital initiative in the region. Cooperation in terms of the digital economy has been included in every EU-EaP summit declaration since 2015. A similar declaration for close cooperation to reap the benefits of the digital economy was adopted for the Euro-Mediterranean

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28 See the full list of countries at: http://topcraftsellers.com/top-etsy-sellers-by-country

29 For more info, see: https://safeboda.com/ug/

30 The Global Entrepreneurship and Development Institute (GEDI, 2020) measures digital entrepreneurship ecosystems, and its Preliminary Report which analysed 116 countries all around the world includes the following rankings for some countries from the region: Israel (23), Russia (48), Turkey (49), Ukraine (54), Montenegro (57), Serbia (62), Georgia (64), Jordan (66), Armenia (67), North Macedonia (68), Moldova (70), Morocco (71), Azerbaijan (72), Kazakhstan (75), Bosnia and Herzegovina (78), Tunisia (80), Albania (81), Egypt (85), Lebanon (89), Algeria (101), Kyrgyzstan (104).

area, which resulted in the establishment of a Digital Economy and Internet Access Working Group and a Digital4med conference in 2019.

In line with these developments, continuous growth has been observed in the ICT sector value added as a share of GDP in the region during the period 2010–17, particularly in Belarus, Serbia, Russia, Israel, Ukraine, Azerbaijan, North Macedonia, and Bosnia and Herzegovina (UNCTAD, 2019). According to Labadze (2019), in 2017 the ICT sector's share of national GDP was particularly high in Ukraine (7.1%), Moldova (5.7%), Belarus (5.1%) and Georgia (3.8%). By comparison, the equivalent figure is 4.2% in Serbia (2015), 3.9% in Bosnia and Herzegovina (2016), 2.8% in North Macedonia (2016), 2.1% in Russia (2015) and 6.2% in Israel (UNCTAD, 2019). This growing trend is quite stable for many countries – e.g. in Serbia the ICT sector share increased +3.8% gross value added from 2016 to 2017 and more than doubled its exports (ETF, 2017c).

In parallel, employment in the ICT sector increased too. In recent years its share in total employment was 4.7% in Israel (2016), 2.7% in Moldova (2017), 2.5% in Serbia (2017), 1.9% in Belarus (2016) and 1.3% in Russia (2015) (UNCTAD, 2019). As ICT services can expand without being constrained by local income and are typically skills intensive, the countries with higher education levels in the population are shifting a higher percentage of employment in ICT services (ADB, 2018). A case in point is the number and share of platform workers from developing countries (see Section 3.5). These factors imply that a critical mass of digital skills is also becoming crucial in the European Neighbourhood countries.

Another important cross-cutting trend is the drive towards the greening of economies in the region, as this is no longer a choice but a necessity dictated by growing environmental degradation, overpopulated urban centres, water scarcity, air pollution and the impact of climate change on food security and infrastructure. Existing environmental reports often include Southern Europe, the Mediterranean Basin and Central Asia among the areas most likely to be affected by global warming and heat waves, decreasing rainfalls and droughts, putting farming and fishing, tourism and infrastructure at risk. Green restructuring requires preserving and restoring the environment, reducing energy, materials and water consumption, de-carbonising the economy, and minimising all forms of waste and pollution. As such, the greening process spreads across many sectors, from agriculture to manufacturing and services, encompassing areas such as construction, energy and extractive industries, transportation and recycling, among others. This requires substantial

upskilling and reskilling of the regional workforce in green competences.

There are numerous examples of policies and actions for green transformation and sustainable development in the region. Having adopted the European Green Deal (2019) to make Europe climate neutral by 2050, the EU provides significant support to the region in pursuit of this goal. Examples of investment in renewable energy are the Ouarzazate solar plant in Morocco (the Noor complex), the Benban solar park in Egypt, a solar energy plant in Tunisia (TuNur project), the increasing number of solar farms in south-eastern Turkey, the New Syvash wind farm in Ukraine, the Biomass project in Moldova, and large-scale wind farms in Kosovo, Montenegro and Serbia. Organic farming is rapidly growing in the countries with a large agricultural sector, while Kazakhstan, Kyrgyzstan and Tajikistan have great potential in terms of hydropower plants. Other projects include the Broad and Innovative Green Economy project in Belarus, Towards Carbon Neutral Tourism in Montenegro, and City Almaty Sustainable Transport in Kazakhstan (UNDP, 2018b). North Macedonia has adopted an energy efficiency law with important implications for the construction sector[31], while Belarus, Serbia, Turkey and Ukraine have strong industrial bases that require adaptation and modernisation to reduce emissions and waste. All these undertakings require the creation of the jobs and skills necessary for building solar/wind systems, constructing/retrofitting buildings, developing more efficient irrigation systems and implementing recycling actions.

2.3.5 Expansion of platform work in the region

No one can dispute the fact that virtual platform work (in online labour markets) creates new opportunities by providing access to work for people who would otherwise be excluded from the labour market, especially in developing countries. Existing studies on platform companies confirm that employers mostly reside in higher-income countries (mainly in the UK, the EU and the US) while their workers are mostly located in lower-income countries (Heeks, 2017; JRC, 2017). This shows the importance of platforms as a conduit for the virtual migration of online workers – although language, time zones and cultural distance still affect the decisions of digital trade. In the UK-based platforms, for example, the non-UK workers mainly come from India, Pakistan, Bangladesh, Ukraine and the Philippines (JRC, 2017).

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[31] See: www.ebrd.com/news/2020/greening-the-western-balkans-region.html

Data provided by the Oxford Internet Institute also indicate that platform work is absorbing many workers from developing countries, and listed India, Bangladesh, the US, Pakistan and the Philippines as the top five suppliers of overall online labour[32]. In this list, Ukraine is ranked 7th, Egypt 10th, Russia 12th, Serbia 18th and North Macedonia 20th. According to an ILO study (2018b), in terms of the amount of financial flows and the number of tasks executed on digital labour platforms, Ukraine occupied the first place in Europe and came fourth in the world. It was also ranked first in the world in 'ICT freelance', as 18% of Ukrainian white-collar workers had already tried digital work and would like to switch to it full-time, and every second white-collar worker views it as a potential additional source of income.

What makes Ukraine unique in comparison with other competing countries is its highly educated labour force, which has ample IT and language skills; yet Ukrainians' earnings and standard of living remain relatively low, while unemployment, underemployment and skill mismatches are high. Economic and military crises, combined with poor law enforcement, informality and very low wages, turn talented professionals into digital workers who can transcend local/national markets and earn income from abroad. Foreign clients can obtain good-quality work at a relatively low cost from Ukrainian workers, while the country's cultural proximity and location in the Eastern European time zone simplifies the online communication of Ukrainian workers with both post-Soviet and European clients (ILO, 2018b).

The number of workers in the global Internet freelance market also confirms similar trends (Analyticshelp.io). The top 10 countries for the highest number of freelancers are the USA, India, the Philippines, Pakistan, Bangladesh, the UK, Ukraine, Russia, Canada and Egypt. As these are also countries with large populations, it is more interesting to look at freelancers per 1 000 people, and in these terms, many countries from the European Neighbourhood appear in the top ten list: Serbia, North Macedonia, Jamaica, Armenia, the USA, Montenegro, Bosnia and Herzegovina, the Philippines, Malta, Barbados and Albania. As Table 2.7 shows, among the EU neighbouring countries, freelancing as a career is most widespread in Serbia, where there are 3.52 freelancers per 1 000 people, followed by North Macedonia, Armenia, Montenegro, Bosnia and Herzegovina, Albania and Ukraine.

Heeks (2017) estimated that there were 45 million registered workers on Western-based online outsourcing platforms in 2015, 36 million of whom were from low- and middle-income countries, with particular concentrations in India, the Philippines, Pakistan and Bangladesh. Online labour markets are often perceived as more inclusive (with less institutional barriers) compared to local labour markets in the region. The allocation of work in platforms tends to be based on merit (competence and performance), not on personal connections and managerial preferences. Although workers from EU neighbouring countries are paid less on average than those in the global North (typically between one-third and two-thirds, with lower reputational profiles or pricing), they earn far more in relative terms (Heeks, 2017). Given the conditions of local labour markets, even if digital work falls short of 'decent work' standards, the digital workers in the region lack such a 'negative perception', reporting high satisfaction and desiring more and consistent work. If 'millions of new digital jobs' appear on a global scale in the coming decade, as claimed by the WEF (2020), a workforce with technological skills will have more opportunities in the region.

2.3.6 Changes in employment patterns and occupational structures

In line with global trends, the European Neighbourhood countries are experiencing changes in employment patterns, mostly in terms of increasing the proportions of non-standard forms of employment, such as temporary and part-time contracts, self-employment, independent contracts, posting of workers and on-call/on-demand working arrangements, among others. The erosion of good jobs can be observed even in the public sector, although the 'gap' in employment/working conditions between the public and the private sector is still visible. The former tends to provide relatively decent jobs with wage employment, while the private sector is infamous for poor wages and working conditions and precarious contracts. The polarisation of jobs has already been felt in places such as Egypt and Eastern Europe – a phenomenon which is feeding rising income and wealth inequality and political populism (see ADB, 2018, Chapter 4).

As a result, these countries have a relatively high share of self-employment. In most cases, self-employment implies low-quality jobs, with the most common form being subsistence farming, especially in countries with a large agricultural sector. However, it is interesting to note that, with a few exceptions, most of the countries in the region have recorded a drop in the share of the self-employed since 2010 (Figure 2.15). This decrease is more

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[32]   See Online Labour Index by country (1–6 July 2017):
       www.oii.ox.ac.uk/blog/where-are-online-workers-located-
       the-international-division-of-digital-gig-work/

Table 2.7. Ranking and numbers of online freelancers, end of 2018

RANK	COUNTRY RANKING BY NUMBER OF FREELANCERS	FREELANCERS	ACTIVE FREELANCERS	% ACTIVE FREELANCERS	FREELANCERS PER 1 000 INHABITANTS
7	Ukraine	53 529	13 798	25.78	1.190
8	Russia	44 534	8 850	19.87	0.310
10	Egypt	33 610	5 490	16.33	0.340
11	Serbia	24 605	5 534	22.49	3.520
29	Turkey	8 790	1 949	22.17	0.110
33	Morocco	7 553	735	9.73	0.210
38	North Macedonia	7 155	1 583	22.12	3.410
40	Armenia	6 325	1 698	26.85	2.180
41	Belarus	6 187	1 280	20.69	0.650
43	Tunisia	5 884	449	7.63	0.510
45	Bosnia and Herzegovina	5 414	927	17.12	1.550
53	Albania	3 769	665	17.64	1.300
54	Algeria	3 629	328	9.04	0.090
55	Israel	3 577	478	13.36	0.410
61	Georgia	2 684	503	18.74	0.730
65	Moldova	2 308	555	24.05	0.660
68	Azerbaijan	2 156	327	15.17	0.220
71	Kazakhstan	1 965	361	18.37	0.110
73	Jordan	1 908	209	10.95	0.200
83	Lebanon	1 473	160	10.86	0.240
92	Montenegro	949	179	18.86	1.580

Note: Online freelancers include only digital freelancers who work via online marketplaces. Offline and independent freelancers are not included. The data is based on publicly available data from World Bank and freelancing sites. The rows highlighted in grey are those countries where freelancing as a career is the most widespread.

Source: https://analyticshelp.io/blog/global-internet-freelance-market-overview-2018/

than 10 percentage points in countries with a large agricultural sector – a particularly significant factor in Egypt, Georgia, Kazakhstan, Moldova, North Macedonia, Serbia, Turkey and Tunisia. However, the reasons for this decline are manifold and vary between countries, from discouraged individuals dropping out of the labour market to others finding wage employment.

Changes in the occupational structure of employment, usually moving towards the creation of higher skilled occupations, is another expected

Figure 2.15. Self-employment (% of total employment), 2000–19

■ 2019   ● 2010   ● 2000
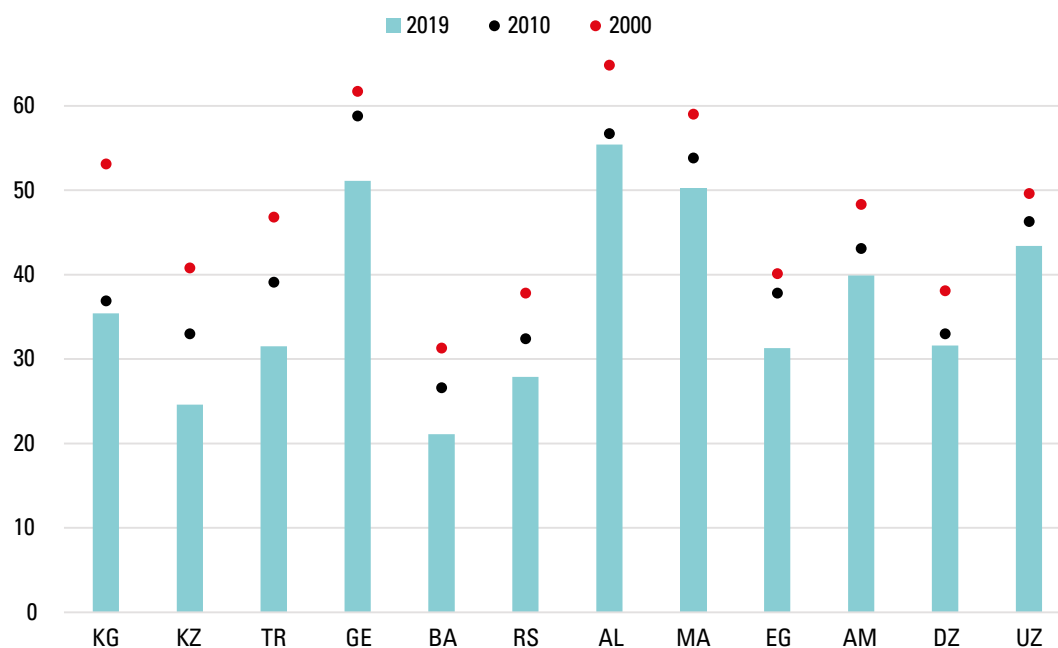
Note: Countries ranked by the difference between 2000 and 2019.

Source: ILOSTAT.

development over time[33]. As Figure 2.16 shows, Ukraine, Serbia and North Macedonia all have a relatively large share of high-skilled occupations (38%, 28% and 28% respectively), while only 17% of the total number of employees worked in high-skilled occupations in Albania in 2018, and in 2019 in Bosnia and Herzegovina the figure was 22% and in Turkey 23%. Over the last decade, the share of high-skilled occupations has increased significantly in Ukraine (by 5 percentage points) and moderately in Turkey and Albania (2 percentage points) as well as North Macedonia (1 percentage point). At the same time, North Macedonia and Ukraine have experienced a significant decrease in low-skilled occupations along with a notable

increase in medium-skilled occupations. A falling share of high-skilled occupations in Serbia and Bosnia and Herzegovina has also been observed. By comparison, in the EU-28 40% of total employment consisted of highly skilled occupations in 2010, which increased to 41% in 2019.

As the medium-skilled occupations include ISCO-6 (skilled agricultural, forestry and fishery workers) and ISCO-8 (plant and machine operators and assemblers), this group may not reflect all the developments in the services sector. Figure 2.17 gives the employment share of high-skilled occupations in other neighbouring countries for which data is available. Exceptionally, more than half of the total employment in Israel is in high-skilled occupations (53%), while Belarus and Kosovo also have relatively high shares (40% and 30% respectively). Since 2010, Tajikistan, Turkmenistan and Uzbekistan have seen an increased share of high-skilled occupations, while Palestine has experienced a significant decrease in high-skilled occupations, similar to Serbia and Bosnia and Herzegovina, the reasons for which should be explored.

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[33]   The International Standard Classification of Occupations (ISCO) groups all occupations into nine groups. The 'high-skilled' occupations include ISCO-1 (legislators, senior officials and managers), ISCO-2 (professionals) and ISCO-3 (technicians and associate professionals). The 'low-skilled' occupations are elementary occupations (ISCO-9). The 'medium-skilled' occupations include ISCO-4 (clerical support workers), ISCO-5 (service and sales workers), ISCO-6 (skilled agricultural, forestry and fishery workers), ISCO-7 (craft and related trades workers) and ISCO-8 (plant and machine operators and assemblers).

Figure 2.16. Employment by ISCO occupational groups (% aged 15+), 2010 and 2019

■ Low-skilled (ISCO 9) ■ Medium-skilled (ISCO 4-8) ■ High-skilled (ISCO 1-3)

	Albania		Bosnia and Herzegovina		North Macedonia		Serbia		Turkey		Georgia		Ukraine		EU-28 average	
	2010	2018	2010	2019	2010	2019	2010	2019	2010	2019	2010	2017	2010	2018	2010	2019
High-skilled	15	17	24	22	27	28	31	28	21	23	25	25	33	38	40	41
Medium-skilled	81	76	66	68	47	60	60	62	64	63	69	67	43	43	50	49
Low-skilled	4	6	10	10	26	12	8	9	15	14	6	7	24	19	10	9

Notes: ISCO classification of occupational groups by low, medium and high is based on the ILO guidelines adopted by the International Conference of Labour Statisticians (ICLS), www.ilo.org/ilostat-files/Documents/description_OCU_EN.pdf. Accordingly, the 'high-skilled' group includes ISCO-1 (legislators, senior officials and managers), ISCO-2 (professionals) and ISCO-3 (technicians and associate professionals). The 'medium-skilled' category comprises ISCO-4 (clerical support workers), ISCO-5 (service and sales workers), ISCO-6 (skilled agricultural, forestry and fishery workers), ISCO-7 (craft and related trades workers) and ISCO-8 (plant and machine operators and assemblers). The 'low-skilled' occupations are ISCO-9 (elementary occupations).

In some countries the occupational classifications and/or labour force survey samples/definitions have changed, which can make comparability of 2010 and 2019 data less reliable.

Source: KIESE database (ETF, 2019a), Eurostat and ILOSTAT.

Figure 2.17. Employment (% aged 15+) in high-level occupations (ISCO 1–3)

■ 2018/19 ■ 2010

Country	2018/19
AZ	23.2
BY	40.1
XK	29.6
JO	17.4
PS	24.2
IL	52.8
TJ	17.4
TM	24.2
UZ	19
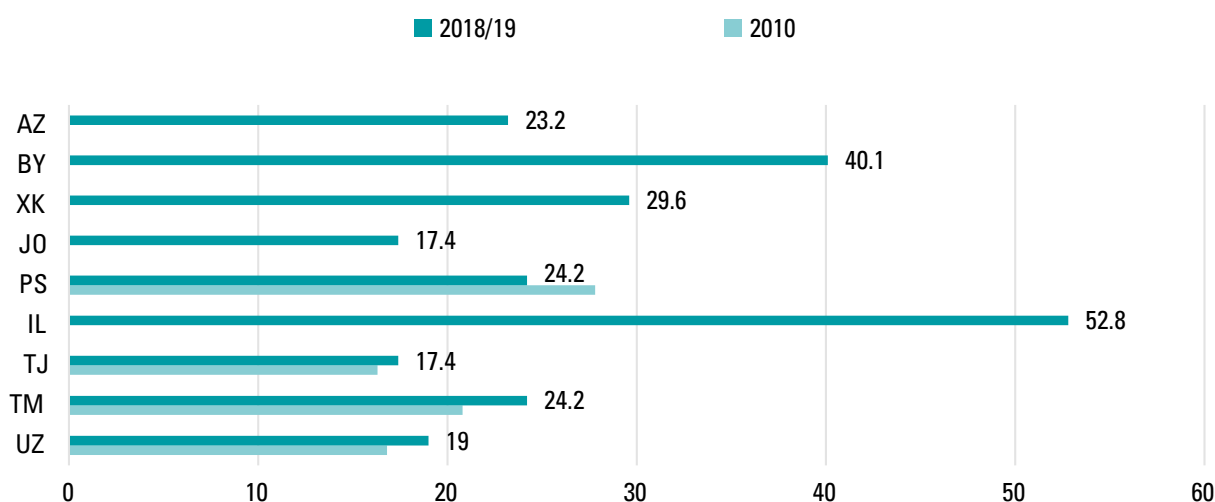
Note: High-skilled occupations include ISCO-1 (legislators, senior officials and managers), ISCO-2 (professionals) and ISCO-3 (technicians and associate professionals).

Source: KIESE database (ETF, 2019a), Eurostat and ILOSTAT.

When a country's economic progress and/or skills structure cannot keep pace with developments, the incidence of skills mismatches and gaps often increases. According to an ETF study (2019d), the occupational mismatch of employees with tertiary education working in semi-skilled occupations is quite high in the region, ranging from some 11 % in Montenegro and 19% in Egypt, to 22% in North Macedonia and Moldova, 24% in Serbia and 36% in Georgia, with men more likely to be mismatched than women. The limited creation of high-end jobs to meet the over-supply of tertiary graduates partially explains a higher incidence of occupational mismatch, although the over-supply often applies to faculties with lower prospects of employment (e.g. law), whereas STEM education does not 'produce' enough graduates. Young people also take up jobs below their level of education or qualifications, hoping to gain work experience. Consequently, this leads to the underutilisation of human capital and increased migration trends.

Moreover, the mismatch between skills supply and the requirements of modern jobs is widening, and some countries have a persistent need for skilled workers with vocational/technical skills. The employers in the region report the problem of skills gaps and complain that the education system produces too few people with transversal and practical skills, the right kind or level of skills, up-to-date knowledge, a good attitude, and self-discipline (ETF, 2019c). Other reports outline the lack of post-secondary non-university level of skills as part of the problem, and short-term higher education and continuing training in particular (ETF, 2017c). A STEP skills study carried out by the World Bank in many Eastern European countries indicates that the most important skills that young workers often lack are technical competence and problem-solving abilities, as well as proficiency in English, leadership skills, and creative and critical thinking[34].

2.4 What skills are required for future labour markets in the European neighbourhood countries?

Based on the observations made in the previous sections, here we look at the types of skills that are needed in the region and the extent to which the neighbourhood countries are ready for future. It is generally accepted that a greater share of people

in the labour force with medium and high levels of education indicates a better capacity to adapt to changes in the future. The European neighbourhood countries vary greatly in terms of the education levels of their workforce, but, regardless, many countries need to increase the numbers of workers with medium- and high-level skills. Figure 2.18 shows that most of the Eastern neighbours and those in the Balkans have a relatively high proportion of workers with a medium or high level of education, while a substantial share of the labour force in countries like Turkey, Palestine and Albania has a low level of schooling. This highlights the importance of adult education and training and the need for greater investment in lifelong learning systems to make this resource accessible and affordable for all citizens.

Adapting to continuously evolving labour markets with upgraded or new skills can be difficult for people with a low level of education (ISCED 0–2). As acquiring new and upgraded skills requires additional learning, those with medium or high levels of education have an advantage in being able to learn more quickly compared to low-skilled workers. Therefore, the share of the active population with only basic education deserves special attention from policy makers. Most 'transition' countries (Armenia, Belarus, Russia, Georgia, Ukraine, Bosnia and Herzegovina, Serbia, Moldova, North Macedonia and Kazakhstan) plus Israel have a small proportion of workers with a low level of education. On the other hand, around two-thirds of the labour force in Morocco, Algeria and Tunisia fall into this category, while those with a low level of education form around half the labour force in Turkey, Jordan, Palestine, Egypt and Albania (Figure 2.19). Although a small decrease in their numbers has been visible since 2010, more needs to be done to improve the human resources of those with low educational attainment if they are to seize the opportunities of the digital age.

A general trend observed in the region is the increasing and broadening competences required from all workers in traditional sectors, shifting the occupational structure towards medium- and higher-skilled profiles. In particular, the medium-skilled technical profiles are important due to the increasing levels of complexity and automation involved in production. For example, a new type of worker with

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[34] See the STEP Skills Measurement Programme: https://microdata.worldbank.org/index.php/catalog/step/about

Figure 2.18. Labour force by education level, 2018

■ Low ■ Medium ■ High

	PS	TR	AL	MD	MK	RS	XK	BA	ME	IL	AZ	GE	BY	EU
High	21	24	20	24	24	26	25	16	28	56	17	34	54	33
Medium	21	21	37	55	56	58	59	69	63	34	76	59	44	48
Low	58	55	43	21	19	16	16	15	10	10	7	7	2	19
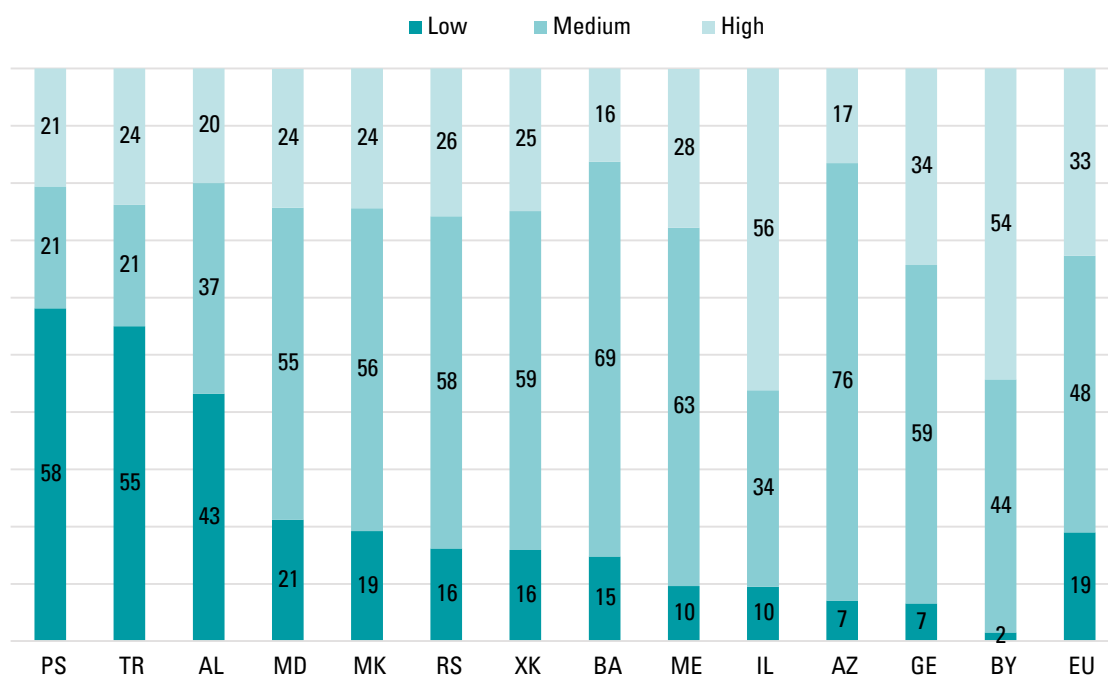
Notes: Low: ISCED 0–2, Medium ISCED 3–4, High: ISCED 5 and above.

Source: KIESE database (ETF, 2019a), ILOSTAT and Eurostat.

Figure 2.19. Share of active population with low education (ISCED 0–2)

■ 2010 ■ 2019

81.7 68.2 63.0 53.1 49.6 42.6 39.6 19.8 18.9 17.7 16.5 16.2 9.0 7.1 6.5 4.2 4.2 2.2 18.5

MA** DZ** TU TR PS AL EG* KZ MK MD XK RS IL AZ GE RU AM** UA EU-28
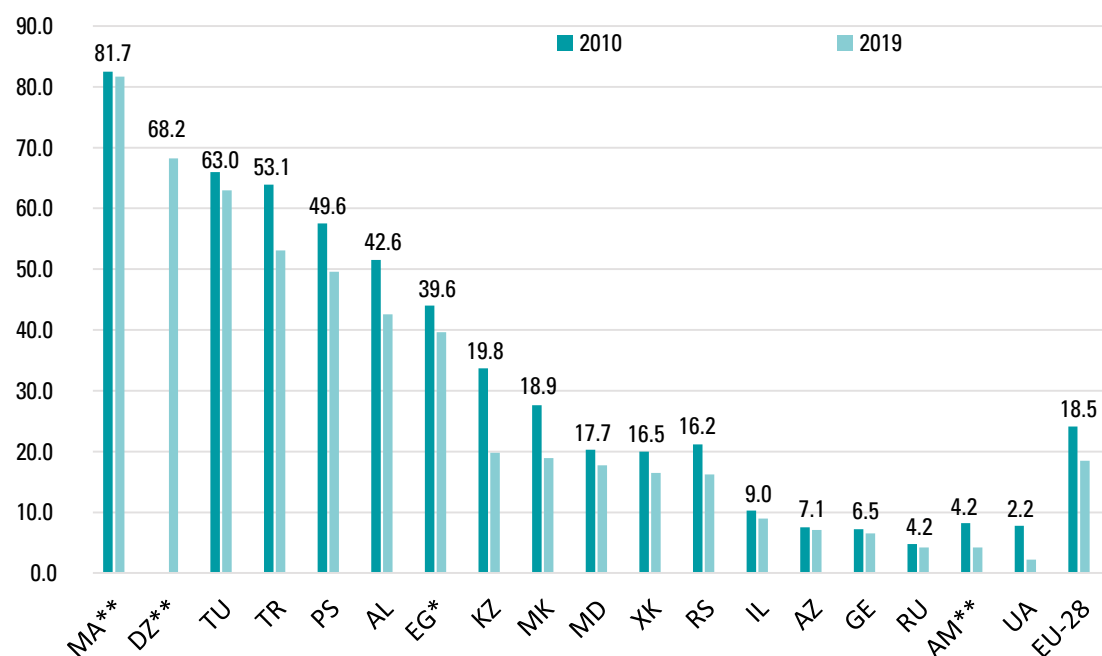
Notes: * 2018, ** 2017 or before.

Source: KIESE (ETF, 2020a) and ILOSTAT.

more technical expertise (termed 'grey-collar')[35] is required in Turkey's automotive sector (ETF, 2020c). These workers possess sophisticated hand-skills in terms of manufacturing, but increasingly they must navigate an environment full of technology. As a result, greater numbers of the blue-collar workforce will need to upgrade their skills to become 'grey-collar' workers (e.g. welders will learn to manage welding robots). This points to the important role of technical and vocational institutions in providing the skills required, and the increasing need for technical colleges or polytechnic schools providing higher VET (higher vocational/EQF level 5 qualifications). Workforce composition is expected to change too: the number of low-skilled workers will decrease in favour of a substantial increase in medium-skilled (and high-skilled) workers.

With the increasing use of new technologies, some employers in the region are expressing a need for specialised workers in specific tech areas (e.g. data science, software development, cybersecurity, robotics, mechatronics and sensors) (ETF, 2020b). Greater demand is also voiced for workers with the capacity to apply their skills transversally over different jobs, and who have horizontal knowledge of many disciplines (so-called 'T-shaped' or 'comb-shaped' skills profiles, i.e. having deep expertise in more than one subject) (see ETF, 2020b, 2020c). The countries which invest more in the teaching of science, technology, engineering and mathematics (STEM) will likely have an advantage in meeting those demands. Table 2.8 shows that some countries in the region have a high share of tertiary STEM graduates (Tunisia, Algeria, Belarus, Russia, Serbia, Jordan and Ukraine), while for others the percentage is very low (Palestine, Armenia and Egypt). In general, more than two-thirds of these graduates are male.

Similar to general global trends, digital education and digital literacy are also becoming significant drivers across all sectors and for all employees in the European neighbourhood region. Acquiring digital skills does not mean having to become a computer scientist, but rather, workers in all occupations, from economists to technicians and receptionists need to be digitally literate, that is, they should understand the basic principles

Table 2.8. Science, technology, engineering and mathematics (STEM) graduates (% of total tertiary graduates), 2018

COUNTRIES	% OF STEM GRADUATES
Tunisia	43.3
Uzbekistan	35.2
Algeria	34.2
Belarus	33.2 (2017)
Russia	30.0 (2017)
Serbia	28.1
Jordan	26.4 (2015)
Ukraine	25.3
Kazakhstan	24.7 (2019)
Georgia	24.6 (2019)
Moldova	23.5
Azerbaijan	23.5
Tajikistan	22.0 (2017)
North Macedonia	21.9 (2017)
Bosnia and Herzegovina	21.2
Kyrgyzstan	20.8
Albania	20.6
Turkey	20.2 (2010)
Morocco	19.0 (2017)
Palestine	15.4
Armenia	15.2
Egypt	11.2 (2016)

Source: KIESE (ETF, 2020a), based on UIS.

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[35] Grey-collar refers to the balance of employed people not classified as white- or blue-collar. It is occasionally used to describe those occupations that incorporate some of the elements of both blue- and white-collar work, and generally falls between the two categories in terms of income-earning capability. Grey-collar workers often have licences, associate degrees or diplomas from a trade or technical school in a particular field. They are unlike blue-collar workers who can often be trained on the job within several weeks, whereas grey-collar workers already have a specific skill set and require more specialised knowledge/training than their blue-collar counterparts. Examples include pilot and flight attendants, paralegals, firefighters, police officers, emergency medical service personnel, chefs, childcare workers and non-physician healthcare workers, among others.

of ICT, and even robotics and coding (a sort of 'third language' alongside one's native tongue and English). The Covid-19 pandemic has further increased the need for everyone to possess digital skills, and the fact that many people around the world have been obliged to telework – whenever possible – requires the development of new competences, not only digital expertise but also adaptability, flexibility and self-organisation.

According to an ICT usage survey carried out in the enlargement region in 2019 (Table 2.9), 62% of adults have above basic digital skills in Serbia, which is closest to the EU-28 average (69%)[36]. In Montenegro, North Macedonia and Turkey more than half of adults possess above basic digital skills. It is worth noting that a higher share of young people aged 16–29 are digitally literate in all countries, but a smaller proportion of females than males have these skills (except North Macedonia). Another very important finding is the very low share of digital literacy among the un/low-educated population.

As mentioned before, the green transformation is another factor leading to the creation, adaptation or elimination of jobs in the region (UNDP, 2018b). The ETF's review of skills for the greener economy in the neighbourhood region indicates that three levels of skills are required in the wider economy: a broad base of knowledge and understanding related to sustainable development; a set of core skills that apply across occupations and which support employment in a variety of contexts; and new specialist skills that apply to the new occupations (ETF, 2011). Would-be organic farmers, for example, will continue to need traditional agricultural skills, but will also have to acquire additional expertise on organic standards and their implementation, as well as gaining an understanding of certification procedures and new channels of potential sales and distribution (see ETF, 2020b, 2020d). Similarly, maintenance workers for windmills need to supplement the traditional skills of the mechanical technician with additional knowledge on the idiosyncrasies of windmill technology. The main challenge is to up-skill across the entire range of jobs and occupations, thus allowing countries to grasp the opportunities that come with the transformation to a green economy and meet the challenges of climate change.

In line with increasing services jobs, soft skills have become as important as technical specialisation in the region. The motivation to learn new things, the ability to self-teach, and learning on the job are important components for adaptation (ETF, 2020b, 2020c). A WEF study on emerging skills in Russia highlights the following: problem-solving; analytical and critical thinking; design skills and creativity; emotional intelligence; technology use, monitoring and control; resilience, stress tolerance

Table 2.9. Individuals aged 16−74 with above basic digital skills, 2019

	BA	ME	MK	RS	TR	XK	EU-28
% of males	44	61	53	64	63	48	69
% of females	38	54	56	60	48	43	69
% of young people (16–29)	70	81	77	82	77	69	84
% of the labour force	49	66	64	75	71	46	77
% of the unemployed	37	53	53	66	68	38	61
% of the un/low-educated	15	28	27	35	35	24	46
Total	**41**	**58**	**54**	**62**	**56**	**46**	**69**

Note: The population of adults consists of all individuals aged 16–74.

Source: Eurostat, ICT usage survey database (isoc_sk_dskl_i).

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[36] Although there is a severe shortage of skilled ICT workers in the country, explicitly expressed by the sector's companies (ETF, 2017c).

Table 2.10. Worldwide Educating for the Future Index 2019 scores, overall and by category (out of 100)

OVERALL SCORE	POLICY ENVIRONMENT	TEACHING ENVIRONMENT	SOCIO-ECONOMIC ENVIRONMENT
1 Finland 84.8	1 Sweden 93.2	1 Finland 82.0	1 New Zealand 87.4
2 Sweden 84.3	2 Finland 88.3	2 Singapore 78.9	2 Norway 87.1
3 New Zealand 79.9	3 Netherlands 88.1	3 Sweden 78.3	3 Finland 86.9
4 Singapore 79.7	=4 New Zealand 86.2	4 Germany 76.4	=4 Sweden 86.0
5 Netherlands 79.2	=4 Singapore 86.2	5 Canada 75.8	=4 Switzerland 86.0
Average 59.8	15 Turkey 75.2	Average 55.5	24 Israel 64.2
29 Israel 57.6	19 Kazakhstan 71.0	31 Russia 50.9	Average 62.2
30 Kazakhstan 57.0	21 Israel 70.6	32 Kazakhstan 50.4	32 Kazakhstan 52.4
32 Turkey 54.9	22 Uzbekistan 70.5	35 Israel 47.2	36 Turkey 49.1
33 Russia 54.1	Average 65.3	37 Turkey 45.2	39 Egypt 46.6
36 Uzbekistan 52.0	32 Russia 65.1	38 Uzbekistan 44.5	41 Russia 45.6
44 Egypt 41.3	43 Egypt 52.7	47 Egypt 32.3	47 Uzbekistan 42.7

Source: The Economist Intelligence Unit, 2019 (Figure 1, p. 6).

and flexibility (WEF, 2020). Thus, a new mindset is sought from individuals and education institutions to prepare citizens for the future. For example, given the limited number of good jobs and continuing restructuring in the region, entrepreneurial skills are crucial for individuals to adapt to changing forms of employment and labour mobility. Also important are career management skills, so that people can make the best learning and career decisions. The countries which invest in key competences (including entrepreneurial skills, foreign languages and core skills) across all education levels will be in a better position to face future challenges,

In 2017, *The Economist* created the Worldwide Educating for the Future Index based on the assumption that today's young people need to develop capabilities and skills in areas such as critical thinking, problem-solving, leadership, collaboration, creativity and entrepreneurship, as well as digital and technical skills. The index assesses the effectiveness of education systems in equipping students with these capabilities in terms of policy environment, teaching environment, and socio-economic environment. Focusing on the 15–24 age band in 50 developed and developing economies, it covers six countries of our region. In the overall score, all six countries rank below the

average: Israel (29), Kazakhstan (30), Turkey (32), Russia (33), Uzbekistan (36), and Egypt (44) (see Table 2.10)[37].

All this implies a societal mobilisation of all institutions and individuals to enable upskilling and reskilling, as well as the reform of education and training systems and expansion towards systems that promote and provide lifelong learning at all levels in the region. Continuing lifelong learning must be part of everyone's future. In terms of current practice, Figure 2.20 illustrates the share of adults (aged 25–64) who participated in training in 2018/19, with Israel showing the highest percentage (9.3% compared with 10.9% in the EU-28). Turkey (5.8%), Serbia (4.4%), Montenegro (2.8%) and North Macedonia (2.3%) also reveal an increasing trend with respect to adult participation in training. A

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[37] According to *The Economist* (2019, p. 22), the need to develop critical thinking has never been so vital, but instilling these future-oriented skills requires acceptance and implementation of certain global values such as gender equality, attitudes toward immigrants, protecting the environment, or freedom of religion and the press. As high-income economies have usually the most open societies, they are more conducive to learning future-oriented skills.

Figure 2.20. Participation in lifelong learning, 2018/19

■ **Adults (25-64)** ● **Young people (25-34)** ● **Women (25-64)**
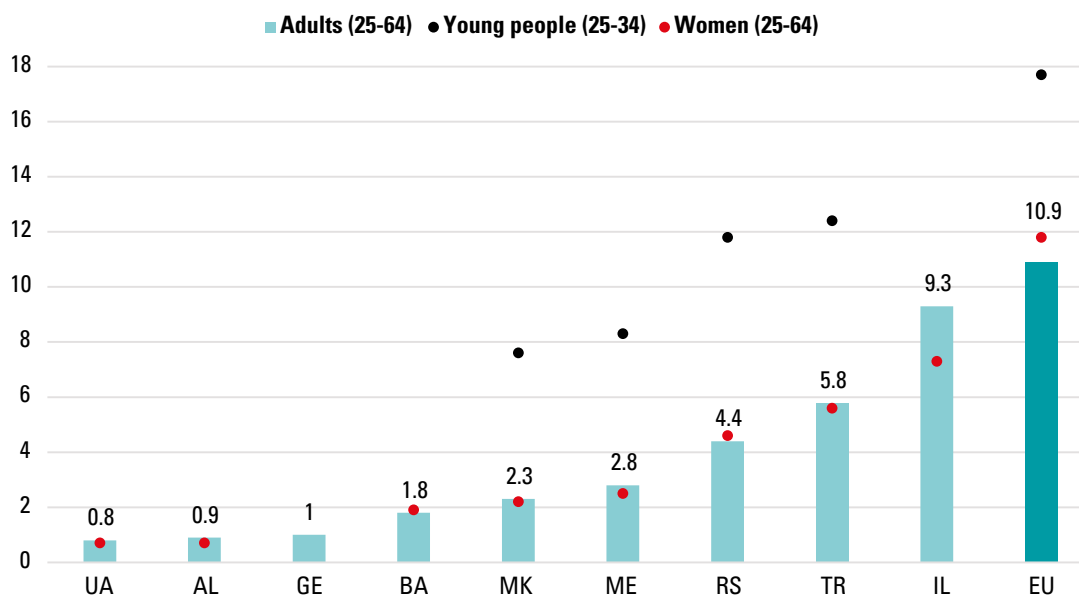
Source: KIESE database (ETF, 2019a), and Eurostat.

promising aspect is the higher participation of young people in lifelong learning in all countries. Other countries in the region where data are available still show low participation rates in adult education (around and below 1%).

Another study of global trends in upskilling and reskilling, however, gives more promising results. A survey of 366 000 people in 197 countries by the Boston Consulting Group (BCG, 2019) found a high percentage of willingness and preference for learning[38]. The survey shows that the workforce knows that change is coming (61% at global level believe their jobs will change) and as a result 65% of them spend significant time on learning each year, from a few weeks to a few months[39].

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[38] The survey explored two specific megatrends – technology changes and globalisation – and two possible reactions to them in 197 countries: people's willingness to adopt new skills for their current positions (upskilling), and people's willingness to pick up new skills for a completely different job, commonly known as reskilling. There are substantial regional differences in people's willingness to learn, and countries are grouped into four categories from the highest to the lowest share of learners: proactive adapters, intrinsic learners, hesitators and bystanders (BCG, 2019).

[39] The majority of learners choose self-directed methods such as studying on their own (63%), on-the-job training (61%), and online training, such as taking courses through online platforms and using mobile apps (a combined 54%). All of these are preferred over learning through traditional avenues including conferences (36%), education institutions (34%), and government-sponsored programmes (7%) (BCG, 2019).

Interestingly, the results point to a more proactive workforce in developing countries who spend more time on learning (including many countries from the region): 85% of respondents had devoted significant time to upskilling each year in Nigeria, Kenya and Brazil, 78% in Turkey, 77% in Egypt, Ukraine, and around two-thirds in Russia, Albania, Bosnia and Herzegovina, Serbia, Tunisia and Uzbekistan. By contrast, the residents in developed countries spend less time on learning such as 43% in Belgium, France and Austria, and 38% in Germany (ibid).

This willingness of the workforce to adapt and train to be ready for change is a good starting point for companies and governments to promote upskilling and reskilling of citizens and to avoid a two-tiered workforce in which some workers are ready for change and others are not. Governments play a vital role in supporting citizens and bolstering the economy by collaborating with industry and educational institutions on upskilling and reskilling initiatives. Examples of initiatives include future-proof education systems, cultivating a lifelong learning mindset in students, individual learning accounts, incentives for corporate spending on learning, support of non-traditional careers and new talent pools, support of continuous learning, recognition of qualifications, certifications or accreditations that are earned in a different country, industry, or job role (BCG, 2019).

2.5 A final word

This article has presented an overview of transformations in the countries neighbouring the EU, with special attention focused on the evolution of the labour markets in the region. The previous sections analysed different factors to gain an understanding of where the European neighbourhood countries stand, how they are affected by the global drivers of change, and what skill demands are emerging as a result. It must be stated that these observations remain experimental and constitute a somewhat general overview of the region. This is partly linked to the diversity of the countries in the region; although there are similarities between them, very different contexts are seen across countries and sub-regions. Moreover, many factors can affect the final outcomes of changes in each country.

There are a number of preconditions that countries need to meet to be ready for the future. First, they need to invest in people, preparing them for what lies ahead. Furthermore, there needs to be a focus on ensuring equal opportunities for every citizen, particularly for more vulnerable groups (i.e. the low-educated, the poor, women and young people), to access better education and training and better employment (ETF, 2018a, 2018b). This would require more flexible education and training systems (e.g. introduction of modular educational programmes), ensuring different learning pathways both within formal education (e.g. transition between VET and higher education) and between formal and non-formal education (e.g. recognition of learning outside formal education through validation of non-formal and informal learning process), and support to the integration of VET in public and private training sectors and enterprises. Second, the mobilisation of all institutions and individuals for upskilling and reskilling effort is a crucial step, requiring significant investment in and comprehensive adaptation of education and training systems at all levels in the region.

Third, countries must carry out constant monitoring of their labour markets in order to understand emerging skills needs for the future. In this way, they can prepare to make the necessary actions in time to meet the upcoming changes. In a number of different countries, where the importance of this process has been understood, there are already some ad hoc initiatives and projects in place aimed at anticipating future skills needs (for a detailed overview, see ETF, 2012, 2016a; European Commission, 2014; Bardak et al., 2016). Such efforts must be expanded and made more systematic by including continuous research, data analysis, assessment and learning by doing. In addition, monitoring should be accompanied by activating flows of intelligent information between producers and analysts of skills data and the education and training sector to act on new learning content and pathways. This circularity of skills intelligence and learning content update is necessary to address the quality and relevance of skills, but not always given (see ETF 2017d; ETF/Cedefop/ILO, 2016b).

Even though the way ahead is still far from certain, countries need to manage their transition to the labour markets of the future. As with any country, understanding the context of the European neighbourhood countries is the first step in managing such a transition, so that, armed with this knowledge, countries can undertake a realistic analysis of where they stand, and then decide where they want to go. They also need to develop 'skills development strategies' that are based on a broad societal and economic consensus as the objectives of one group alone will not succeed in managing the transition. Each country's future will be shaped by the present state of its economic and technological development and the political vision of its institutions, as well as by its level of human capital.

As stated in Article 1, no country is locked into a single future. Depending on the policies of the state, its institutional capacity, and the ability of all its economic, social and political actors to work collectively, countries may have several possible futures. The outcome for each country will be the result of choices made by the state and its institutions, by economic and political elites, and by the people themselves.

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PART 2

CHANGES IN OCCUPATIONS, SECTORS AND EMPLOYMENT PATTERNS

ARTICLE 3
RISK OF AUTOMATION TO JOBS IN THE URBAN AREAS OF ARMENIA, GEORGIA, MOLDOVA AND NORTH MACEDONIA

Bilal M. Khan and Siddhartha Raja[1]

This article is focused on quantifying the risk of automation faced by workers in the urban areas of four countries – Armenia, Georgia, Moldova and North Macedonia. Two common methodologies are used to estimate the proportion of jobs at high, medium and low risk of automation in these countries. Using the STEP (Skills Toward Employment and Productivity) household survey data, even a more conservative job-based approach suggests that, on average, 15% of the urban jobs in these countries are at high risk of automation. However, there is significant variation across countries, with Moldova and North Macedonia having higher risks of automation than Georgia and Armenia, primarily due to the sectorial and occupational structure of employment there. These countries will experience job polarisation in the future, whereby the majority of medium-skilled jobs could potentially be lost in manufacturing and construction as well as the agriculture, fisheries and mining sector if no actions are taken to address the challenges arising from automation. The results of this study suggest that the workers in these countries need to be equipped with digital as well as soft skills to protect them from becoming redundant at work and help them transition to better jobs.

3.1 Introduction

Since the first industrial revolution, in the long run, technology has always led to improvements in the productivity of workers and the creation of new and better jobs in the economy. In the short run, however, improvements in productivity lead to the loss of some old jobs, depending on the speed of adoption of new technologies among firms and workers. In the last two decades, automation (the third wave of industrialisation) has already significantly impacted labour markets in the developed world, where machines have replaced a sizeable proportion of medium-skilled jobs concentrated in the manufacturing sector. It has also created many more high-skilled jobs, especially in the services sector. However, it will require significant upskilling (or re-skilling) to move these medium-skilled manufacturing workers into high-skilled jobs in services. The impact of automation is further compounded by the significant

fall in the price of Information and Communication Technologies (ICT) as well as transportation costs, which has transformed the world into a global village. Today it is feasible for companies like Apple to design their products in California but manufacture them in East Asia, taking advantage of the cheap labour in there and exploiting the comparative advantages of using workers across different regions.

Autor et al. (2003) first pointed out that machines are replacing those jobs that follow explicit rules, making the technology easy to programme. Such jobs were classified as routine jobs. It was further argued that most of the medium-skilled (manufacturing) jobs in the US and Europe were routine in nature and that the automation of such roles was mainly responsible for the polarisation in the US labour market that has taken place over the last two decades (Autor et al., 2013). Frey and Osborne (2017) aimed to quantify the impact of automation on jobs in the future, specifically the next two decades. They described the structure of 702 six-digit occupation codes, as classified by the US Bureau of Labour Statistics, to a team of computer science experts and asked them to assign a probability of automation to each of these

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codes. They found that nearly 47% of the current workers in the US are employed in occupations that would be at high risk of automation in the future. They assigned the same probability to a specific occupation code irrespective of the industry, region or size of the firm.

Arntz et al. (2016) argued that the tasks performed by workers within same occupation code differ across sectors, even within the same country. They suggested that it is the tasks that are susceptible to automation and not the occupation as a whole. If the majority of the tasks in a job are susceptible to automation, that role would have higher chance of being replaced by a machine. The PIAAC database (Programme for the International Assessment of Adult Competencies) was used to examine 21 OECD countries, and it was discovered that once the variation in the task structure was taken into account, the risk of automation was much less pronounced. Arntz et al. found only 9% of jobs in the US to be at high risk of automation.

There has been some anecdotal evidence suggesting that automation is already affecting jobs in the developing world; China and Bangladesh, for example, are now facing a similar problem. In order to remain competitive in the international market, China has been the biggest importer of Industrial robots in the past decade. In 2015, Foxconn, a major assembler of Apple iPhones, cut 60 000 jobs in one factory as a result of automation (Wakefield, 2016). In the last decade, Bangladesh has overtaken many textile exporters and is currently ranked only behind China. Bangladesh has one of the world's cheapest labour force in the textile sector. However, many garment manufacturers in Bangladesh are also replacing manual labour with machines to remain competitive in the global market (Emont, 2018). If companies do not automate, they will forfeit their market share to other firms who are more competitive and, as a result, will lose their businesses too.

Motivated by such anecdotal evidence, this paper aims to study the impact of automation on the labour markets in Armenia, Georgia, North Macedonia and Moldova, and examine how well prepared these countries are to address this issue. We will employ both methodologies mentioned above (i.e. those used by Frey and Osborne (2017) and Arntz et al. (2016)), to calculate the distribution of risk among the urban workers in these countries. However, we will focus the discussion on the results based on the methodology of Arntz et al. (2016) for two reasons.

Frey and Osborne (2017) classified the risk of automation at the occupational level, which may

be called the occupation-based approach. They assumed that every worker in a specific occupation would face the same risk of automation irrespective of the skills employed in their job. One can easily replace an accountant for a small business (e.g. a local restaurant) with *quickbooks* (an accounting software), but it would be almost impossible to replace an accountant at a big accounting firms with a software. Thus the first reason for not focusing on their methodology is that they give the same probability of automation for both of these accountants, despite the fact that the one at the big accounting firm will be employing advanced computational as well as communication skills for her work which are not readily automatable. Secondly, Frey and Osborne (2017) estimated the probabilities based on the US Bureau of Labour Statistics' definition of an occupation, which does not account for the socio-economic conditions that people work in or the supporting infrastructure in the country. It might be worthwhile to automate jobs in the agricultural sector in the US as the labour costs there are very high and the mechanical equipment is readily available, whereas it might not be financially feasible to automate agricultural jobs in Moldova.

By contrast, Arntz et al. (2016) account for the variation in the structure of the jobs based on industry, location, skills used for work and other socio-economic factors. They focus on the tasks performed in a particular role and calculate the risk at the job (worker) level, so their methodology will be referred to as the job-based approach[2]. Overall, Arntz et al. (2016) have shown that the job-based approach suggests that a much lower proportion of jobs are at high risk of automation compared to the occupation-based approach adopted for the OECD countries.

This article is split into five sections. Section 3.2 summarises the implications of technological advancements on the labour market in general. Section 3.3 provides an overview of the urban economy in the four countries covered in this study, using the Skills Toward Employment and Productivity (STEP) Household survey, and discusses the methodology used to calculate the risk of automation. Section 3.4 presents the results of these methodologies with a focus on the job-based approach. Section 3.5 discusses possible responses to the potential risk of automation in these countries, and Section 3.6 concludes.

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[2]   These terminologies are taken from Arntz et al. (2016).

3.2 Impact of automation on the labour market

Automation presents opportunities as well as challenges to these four countries with declining or stagnating populations. The challenges for workers in these transforming countries arise from having to compete against not only other countries (workers as well as firms), but also against the machines which are causing productivity to rise and costs to fall over time. Opportunities also arise as a result of new jobs opening up with the advancement of ICT technologies, alongside the reduction of transportation costs. Most of these countries are facing declining populations and robots can assist firms in improving the productivity of the workforce, thereby helping these countries to grow their GDP at healthy rates.

Furthermore, the availability of a digital infrastructure has the potential to open up global markets to producers in these four countries; for example, a tourist guide or a local host from Georgia can easily connect with tourists from as far away as East Asia, using modern digital technologies to market the beautiful landscapes and hospitality services of their country. A software programmer in Moldova or a Russian language teacher in Armenia is not bound by the buying power of the local market as they can promote themselves online and thus earn much higher wages. Even within the economy, a farmer in a rural area can now directly monitor the prices in far-off cities as well as receive weather forecasts on an hourly basis, helping them to optimise the production of crops and set prices for their farm produce.

Technology primarily affects workers in the labour market in three dimensions – in the quantity, quality and distribution of jobs.

3.2.1 Quantity of jobs

Automation increases the productivity of the firm as well as the individual employee by raising the rate of output for a given number of workers. This increase in productivity has two opposing effects. Firms will require fewer workers to produce the same level of output because of the increased productivity. However, with the increased output per worker, the cost of production goes down, which will lead to a reduction in the price and increased demand. As the new digital technologies can help firms connect with foreign consumers, this increased productivity will help them become more competitive in the international market and will result in more demand for their products. The firms and the countries that have adopted the new technologies will have an edge and be able to rapidly increase the number of

jobs available. However, these new technologies will require the current workers to upgrade their skillsets so that they can learn to operate the new machines. The workers and firms that resist this upgrading will become less competitive and lose their market share to either local or foreign firms that have adopted the relevant modern techniques.

3.2.2 Quality of jobs

The quality of new jobs created as a result of automation is greater as more specialised skills are required on the part of workers to operate the new technology, resulting in higher wages for these jobs. Moreover, digital technology has created new kinds of jobs which did not exist previously. For example, many people now consider vlogging and blogging as a professional career, even in the developing world, with the new technology helping them to reach out to their audience at negligible cost. There are also many vendors in Viet Nam who are selling merchandise through Facebook, which enables them to reach a customer base that was not accessible a decade ago. These new platforms provide relatively high paying jobs (or profits) but they require the efficient use of digital technologies as well as good communication skills. Sellers have to learn how to communicate effectively with customers through these platforms. This way of working has further led to the concept of the platform economy, whereby ride-sharing as well as accommodation-sharing services have sprung up all over the world. These new jobs in existing as well as new sectors require all workers to learn some basic digital skills, even those who do not work directly through online platforms. This not only helps workers to update their knowledge using the internet but they also learn about possible solutions to new problems at work; for example, if an electronic technician sees a new kind of phone or laptop, she can easily learn about how to fix certain issues by searching online, and thus charge a premium for repairing the latest gadgets.

3.2.3 Distribution of jobs

The new technology also affects the distribution of jobs, not only within the economy but across countries as well. Once Japan and South Korea were the factories of the world but now even most of the Korean and Japanese firms have moved their production to China, India and other Southeast Asian countries. These firms have themselves moved up the value chain, employing most of their own staff in the design and sales and marketing of the manufactured products. Most of the tradable jobs in the developed countries have thus been either replaced by machines or moved to the developing countries. This has resulted in the hollowing out

of the labour market in these countries, as many medium-skilled workers have lost their jobs to automation. As a result, they must either retrain or upgrade their skills to gain more highly skilled work, or are forced to take low-skilled jobs. Some of the developing countries who benefitted significantly from offshoring in the last decade – for example China, Viet Nam and Bangladesh – are now facing a similar problem. If they do not automate, they will lose their market share to other firms that are more competitive and, as a result, workers will be made redundant. Thus, the new technological developments are shifting jobs between sectors not only within the economy but also across countries.

3.3 Data and methodology

3.3.1 STEP survey data

Skills Toward Employment and Productivity (STEP) is a series of surveys conducted by the World Bank in developing countries to assess the supply and demand for skills[3]. It consists of an employer survey and a household survey for each country. We have used the STEP household survey data to quantify the risk of automation. The survey was conducted in 2013 in Armenia, Georgia and North Macedonia, and in 2019 in Moldova (see Table 3.1). Detailed information was collected on between 2 000 and 4 000 randomly selected adults in the urban areas

of these four countries. It should be noted that the STEP survey was conducted only in the urban areas and so was not the representative of the whole economy (Pierre et al., 2014) – a factor which it is important to bear in mind when interpreting the results of the analysis.

Table 3.1 provides the summary statistics for the STEP survey conducted in the urban areas of all four countries under examination. It should be noted that North Macedonia recorded almost twice as many observations as Moldova and that women are overly represented in these surveys in relation to their share of total population as well as in terms of employment[4]. The median worker of the urban workforce in these countries is in their early forties, highlighting an older workforce. This is primarily because of a relatively high rate of emigration among young workers from these countries to the EU countries or the Russian Federation (see Atoyan et al., 2016) as well as low fertility rates. These countries also have much lower levels of self-employment compared to other developing economies in the world.

3.3.2 Overview of the urban economy

All four countries have the basic urban infrastructure to become modern vibrant economies and are situated right next to the biggest economic market

Table 3.1. Summary statistics, STEP survey, urban areas of four countries

	ARMENIA	GEORGIA	MOLDOVA	NORTH MACEDONIA
Year of the STEP survey	2013	2013	2019	2013
Total observations	2 992	2 996	2 070	4 009
Females	2 145	2 016	1 361	2155
Employed (20 years or older)	969	890	816	1 617
Females employed (20 years or older)	604	560	521	733
Self-employed	119	135	75	315
Part-time workers	187	198	162	131
Median age of employed workers	42	41	43	41

Source: World Bank, STEP survey data.

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[3] For a detailed description of STEP surveys, see Pierre et al. (2014).

[4] We have used the survey weights in the regression analysis to adjust the over-representation of women in these datasets.

in the world, the European Union. They also each have a relatively high proportion of the workforce in high-skilled occupations in urban areas compared to other developing countries[5].

Figure 3.1 highlights that, on average, all four countries have about a third of their urban workforce employed in the top three occupational groups (managers/senior officials, professionals and technicians/associate professionals). On the other hand, most of the medium-skilled workers of the urban workforce are concentrated in the retail sector (i.e. the services and sales sector). Moldova has a relatively high proportion of urban workers in elementary occupations, since a major proportion of workers living in urban areas here are also involved in agriculture.

Figure.3.2 shows the distribution of the urban workers across the major economic sectors. As in Figure 3.1, Moldova has higher proportion of urban workers involved in the agricultural sector than the

Figure 3.1. Distribution of urban workforce across occupations

- Managers
- Clerical Support workers
- Craft and related Trade workers
- Professionals
- Services and Sales workers
- Plant and Machine operators and assemblers
- Technicians and Associated Professionals
- Skilled, Agricultural, Fisheries and Mining workers
- Elementary Occupations
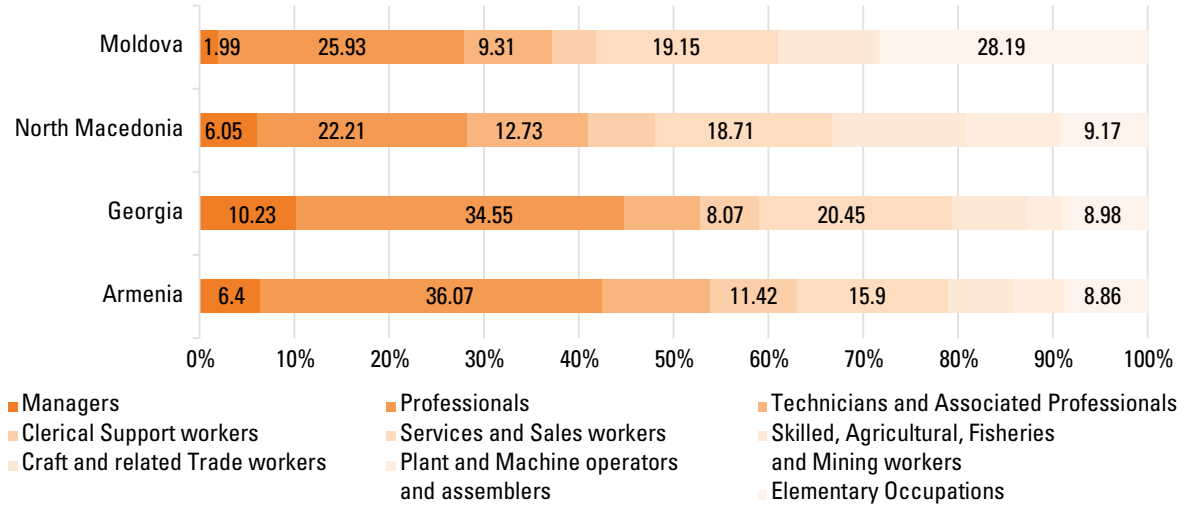
Source: World Bank, STEP survey data.

Figure 3.2. Distribution of urban workers across industries

- Agriculture, Fisheries and Mining
- Manufacturing and Construction
- Commerce
- Other Services
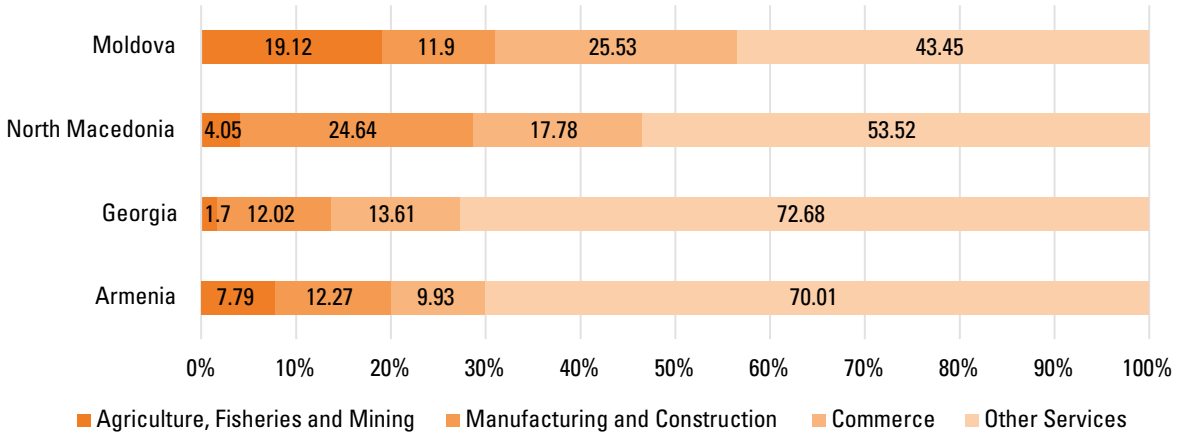
Source: World Bank, STEP survey data.

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[5] See Khan and Raja (2020) for a detailed distribution of workers across occupations in the STEP countries.

Figure 3.3. Distribution of educational levels of urban workforce
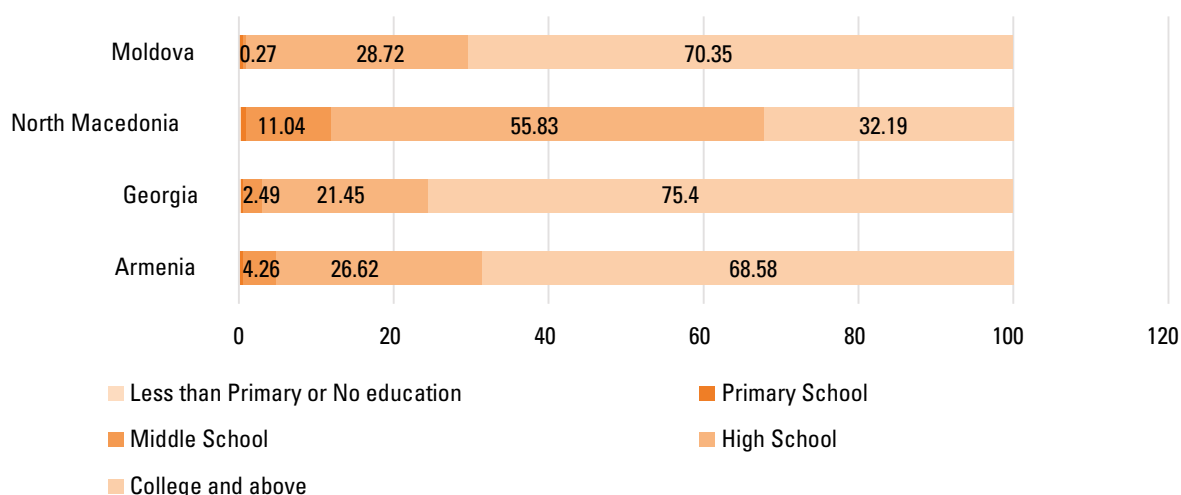
Source: World Bank, STEP survey data.

other three countries. The share of 'other services' workers exceeds 70% in the urban areas of both Armenia and Georgia, whereas North Macedonia has a relatively high proportion involved in the manufacturing and construction sector (one quarter of the urban workforce).

Figure 3.3 illustrates the educational distribution of the urban workforce in the four countries, showing a relatively high level of education among the workforce, relative to the countries with similar GDP per capita. The median level of education reached for urban workers in Armenia, Georgia and Moldova is college level (ISCED levels 5–8 together), while for North Macedonia it is high school (ISCED levels 3–4 together). It is worrying that although Moldova has relatively high level of reported education, it still employs a significant share of urban workforce in the elementary operations of the agricultural sector. We will discuss later in more detail the question of the missing skills and infrastructure which affects the competitiveness of these workers.

3.3.3 Methodology

In this study we employ both the above-mentioned methodologies (i.e. job-based and occupation-based approaches) to calculate the proportion of jobs in these countries at potential risk of automation and provide a comparison of these two methodologies at the aggregate level. However, as noted earlier, we will focus on the results from the job-based approach, as it accounts for variations in the socio-economic conditions of the workers as well as the structure of the local economy, which is more realistic than assuming, for example, that all kinds of accountants face a similar risk of automation.

Frey and Osborne (2017) calculated the probability of automation for each of the six-digit SOC codes, whereas the STEP survey uses the three-digit ISCO code to classify workers' occupations[6]. In order to implement the occupation-based analysis, we matched the three-digit ISCO occupation code with the six-digit SOC occupation codes for which Frey and Osborne (2017) calculated the probability of automation. For those three-digit ISCO codes where there was more than one matched six-digit SOC code, we simply assigned the average of the matched SOC codes to the given ISCO code.

Job-based analysis uses the individual's characteristics, the job's characteristics and task-related information collected in the STEP survey and conducts a regression analysis to estimate the probability of automation for each individual worker in these countries[7]. Table 3.2 reports the regression results and highlights the importance of considering different tasks in assessing the risks of automation. It should be noted that we have used STEP survey data for 13 developing countries to calculate the job-based probabilities in order to conduct a more robust analysis of the variation in tasks across the same occupations[8]. The following interpretation

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[6] Standard Occupational Classification (SOC) is a standard classification used by the Bureau of Labour Statistics in the US, while the International Standard Classification of Occupation (ISCO) is a standard classification agreed by ILO members to consistently classify different jobs into a defined set of groups (occupations) based on their duties.

[7] See Khan and Raja (2020) for a detailed description of the methodology.

[8] The 13 countries used for this analysis are Armenia, Bolivia, Colombia, Georgia, Ghana, Kenya, Laos, Moldova, North Macedonia, Philippines, Sri Lanka, Viet Nam and Yunnan (Chinese province).

Table 3.2. Determinants of probability of automation (job-based approach)

		COEFFICIENT	STANDARD ERRORS
Individual characteristics	**Female**	-0.01	0.01
	Age	0.00	0.00
	Primary school	0.01	0.01
	Middle school	0.04	0.01
	High school	-0.02	0.01
	College and above	-0.24	0.01
Job characteristics	Self employed	0.02	0.01
	Part time	-0.03	0.01
	Experience required	-0.11	0.01
	Requiring middle school or high school	-0.04	0.01
	Requiring college and above	-0.15	0.01
Task information	Physically demanding	0.02	0.00
	Level of repetitiveness	0.02	0.01
	Autonomy at work	-0.01	0.00
	Thinking at work	-0.04	0.00
	Learning new things at work	-0.03	0.00
	Operating heavy machinery	0.12	0.01
	Supervising others	-0.09	0.01
	Client interaction	-0.07	0.01
	Presentation at work	-0.03	0.01
	Basic computing	0.05	0.01
	Reading level at work	-0.12	0.00
	Basic mathematics	0.03	0.01
	Advanced mathematics	-0.10	0.01
	Advanced computing	0.06	0.01
	Constant	0.95	0.03
	Industry fixed effects	Yes	
	Country fixed effects	Yes	

Note: The variables highlighted in bold have negative correlation with the probability of automation.

Source: These regression results are based on STEP data for 13 developing countries: Armenia, Bolivia, Colombia, Georgia, Ghana, Kenya, Laos, Moldova, North Macedonia, Philippines, Sri Lanka, Viet Nam and Yunnan (Chinese province).

is valid for all countries in the analysis, that is, Armenia, Georgia, Moldova and North Macedonia.

Results from the regression (Table 3.2) indicate the following trends in terms of individual characteristics: Females are employed in jobs that have a lower chance of being automated. Similarly, age is also negatively correlated to automation, suggesting that more experienced workers are employed in occupations which are difficult to automate. A higher education level helps to protect against automation, as more highly skilled jobs require an advanced level of education. In terms of job characteristics, the jobs requiring a higher education level or more experience, or which are part-time, have a lower probability of automation, whereas self-employed workers, and jobs that are physically demanding or repetitive in nature are more at risk. The relationship between automation and self-employment is counter-intuitive in the sense that most entrepreneurial activity is more creative in nature and cannot be replaced by machines. However, this perception is valid only for voluntary self-employment. Most of the self-employed workers in the developing world are involuntarily self-employed, that is, they could not find any other job, so were forced to become self-employed as a way of earning a living (Khan and Kim, 2020).

In terms of task information, the presence of non-routine tasks that require skills like autonomy, thinking, learning new things at work, advanced mathematics, supervision, presentation at work and client interaction reduces the probability of automation. Autonomy, thinking and learning new things at work require cognitive skills in order to perform complex tasks, during which the worker has to analyse problems which are not standardised. This can include a medium-skilled job like plumbing, especially in the developing world. Every customer might have different piping and the plumber has to analyse the issue first before resolving it. Similarly, supervising workers, presenting your work and interacting with clients all involve communication skills which can be non-routine in nature. A retailer should be able to use soft skills with her clients tailored to their requirements. These tasks require effective communication skills and/or emotional literacy, which will be difficult to automate in the near future. However, jobs requiring basic mathematics or simple computing will be prone to automation in the future, as computers are much better adapted to perform these functions than the average worker in the developing world[9], whereas

advanced mathematical skills are negatively associated with automation in these countries.

3.4 Results

3.4.1 Risk of automation across countries

Figure 3.4 provides a comparison of results for the two different methodologies in the form of a box plot distribution of risk relating to the workers in the urban areas. We notice that the occupation-based approach suggests either a very high or a very low probability of automation for the majority of the workers, whereas the job-based analysis suggests medium risk for most of the jobs in these countries. This can be seen from the probability of automation for the 25th and 75th percentiles of workers in both approaches; for example, in Moldova, using the occupation-based approach, the top quartile of the workforce has a probability of automation above 83% whereas the bottom quartile has a probability of below 9%. Similarly, using the job-based analysis for Moldova, the top quartile's probability is above 69% and the bottom quartile's probability is below 35%. Occupation-based analysis thus suggests job polarisation, as most of the workers are either at very high or very low risk of automation, while the job-based approach indicates that the probability of automation for the majority of the urban workforce is somewhere between 30% and 70%.

For the rest of the analysis, we classify the risk of automation as high risk (a probability greater than 70%), medium risk (a probability between 30% and 70%) and low risk (a probability less than 30%). Since a higher probability of automation means that a greater proportion of the tasks performed by an individual are automatable, we believe that high-risk jobs cannot be saved and will be replaced by the machines. Although a significant proportion of the tasks in medium-risk jobs will also be automated, the individual has the opportunity to significantly upgrade her skills to avoid being replaced by machines. In low-risk jobs the majority of tasks are at very low risk of being automated, so workers in this category will survive with minimal investment in skills upgrading.

Figure 3.5 provides a comparison among these four countries according to the job-based approach. The proportion of jobs at high risk of automation varies significantly among these countries, from less than 5% for Georgia to over 20% in Moldova, whereas nearly two-thirds of the urban workforce in

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9   Advanced computational skills also have a positive relationship with automation, though it should be

highlighted that there are very few workers reporting the utilisation of advanced computational software for their work in these countries.

Figure 3.4. Distribution of risk of automation among the urban workers (job-based vs occupation-based)
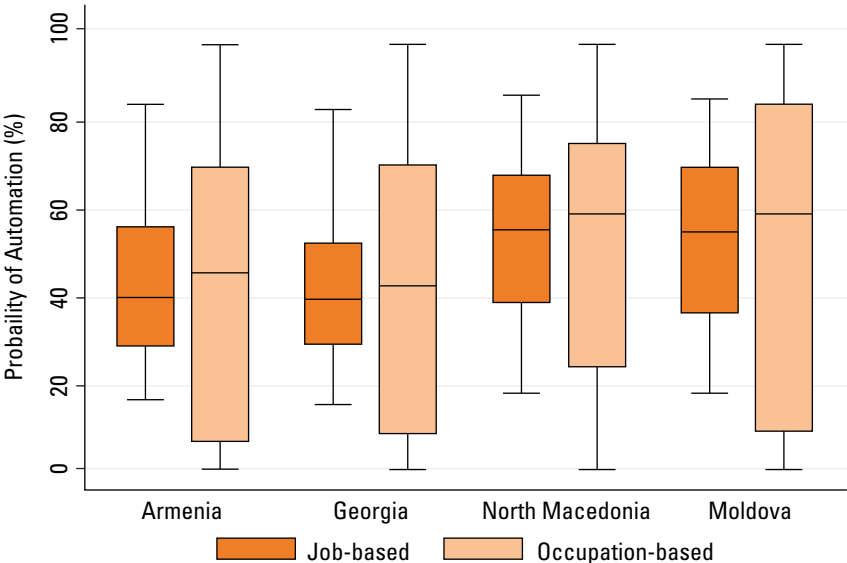
Note: The outliers have been excluded.

Source: World Bank, STEP survey data.

Figure 3.5. Risk of automation in the urban areas (job-based approach)
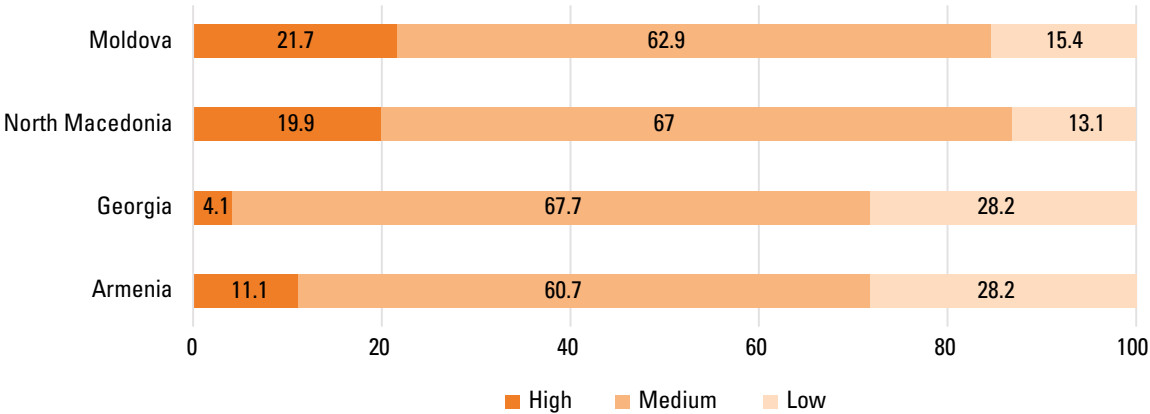
Note: High risk of automation: probability greater than 70%; medium risk: probability between 30% and 70%; low risk: probability less than 30%.

Source: World Bank, STEP survey data.

these countries are at medium risk of automation. This suggests that the majority of these workers might not be replaced by machines but that about two-thirds of them will see a significant proportion of their tasks being automated in the future, thus exerting pressure on the wages of those remaining in work. In order to stay competitive in the labour market of the future, these workers at medium risk will require to upgrade and improve their skills.

3.4.2 Distribution of risk across occupations
Figure 3.6 shows the distribution of risk across the major occupational groups in the four countries with the aim of identifying which of the occupations are facing a lower risk of automation. We can see that high-risk workers are mostly concentrated among the low-skilled jobs, especially elementary occupations, and medium-skilled workers, in particular clerical

Figure 3.6. Risk of automation across major occupations in the urban areas of the four countries (job-based approach)

Occupation	High	Medium	Low
Elementary Occupations	42.6	55.9	1.5
Plant and Machine operators and assemblers	36.2	62.6	1.2
Craft and related Trade workers	24.6	74.4	1
Skilled, Agricultural, Fisheries and Mining workers	56.2	43.5	0
Services and Sales workers	17.2	80.2	2.6
Clerical Support workers	7.3	80.9	11.8
Technicians and Associated Professionals	2.9	76.8	20.4
Professionals	1.4	48.4	50.1
Managers	3.1	66	30.9

■ High ■ Medium ☐ Low
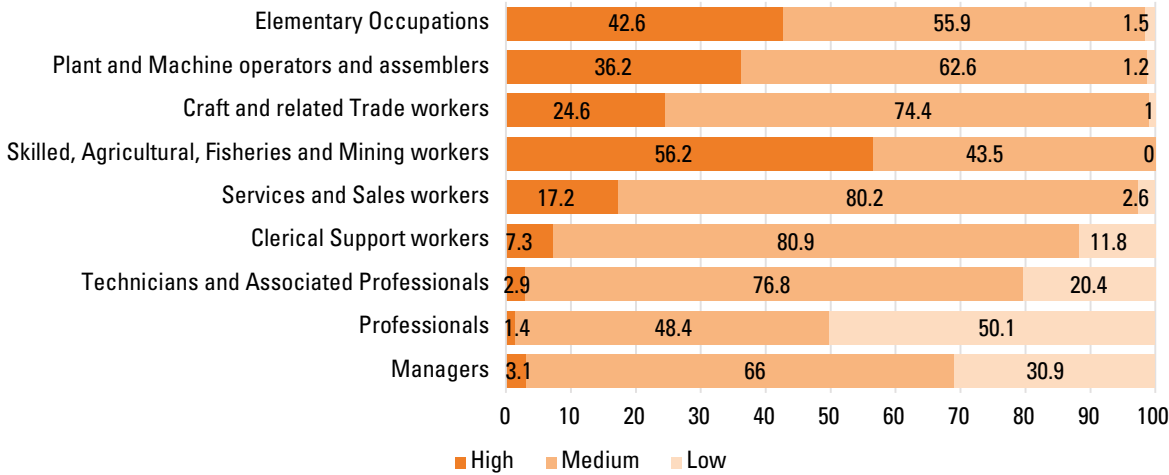
Source: World Bank, STEP country survey data.

support workers and those working in the skilled agricultural, fisheries and mining sector. The majority of high-skilled workers are exposed to a low risk of automation. This shows that we will see a proportionally greater decline in jobs in the medium- and low-skilled occupations, leading to more pronounced income inequality in these countries. On the other hand, a negligible proportion of the jobs encompassing managers, professionals and technicians and associated professionals appear to be at high risk of automation, suggesting that the new technology has a complementary role in high-skill occupations.

3.4.3 Distribution of risk across economic sectors
Figure 3.7 shows the distribution of automation risk across the major economic sectors in the

four countries. We notice that two-thirds of the workers in the agriculture, fisheries and mining sector face a high risk of automation, as we have already seen in most of the developed countries. However, considering that the STEP survey was conducted in urban rather than rural areas and that most of the workers in the countryside are involved in agriculture, these results also do not present a promising future for those rural workers. Manufacturing and construction is the second most vulnerable sector, with nearly 30% of its workforce facing a high risk of automation. Other services have a negligible proportion of workers at high risk, but still a significant proportion will be at medium risk. It is evident that as the routine nature of the occupation is reduced, so is the risk of automation. Agriculture, fisheries and mining have the most repetitive jobs among the sectors and hence

Figure 3.7. Risk of automation across major industries in the urban areas of the four countries (job-based approach)

Industry	High	Medium	Low
Other Services	1.3	65	33.8
Commerce	26.1	73.9	0
Manufacturing and Construction	29.6	70.1	0.3
Agriculture, Fisheries and Mining	66.2	38.2	0

■ High ■ Medium ☐ Low
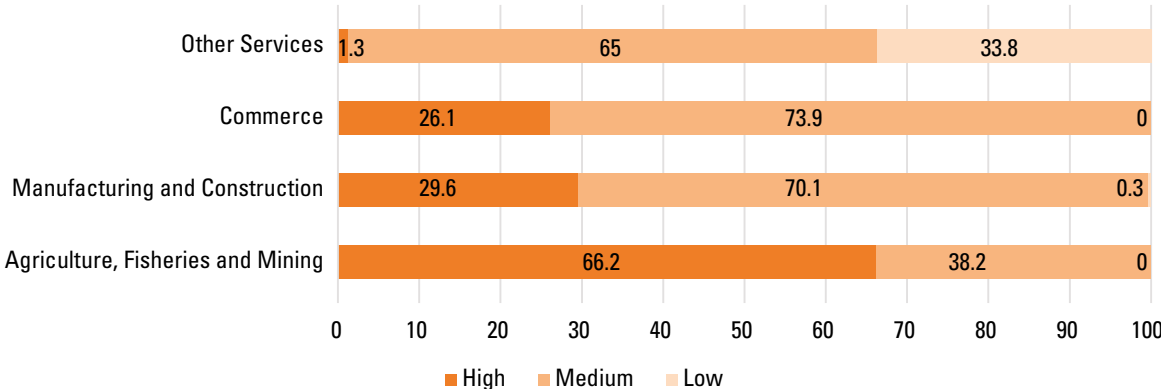
Source: World Bank, STEP country survey data.

this sector faces the highest risk of automation, whereas services are usually non-routine in nature and as a result, face the lowest risk of automation.

3.4.4 Distribution of risk across educational levels

Figure 3.8 indicates the risk of automation across the education levels of the combined urban workforce of these four countries and corresponds to the analysis in Figure 3.6. These figures suggest that the higher the level of education (or skill), the lower the risk of automation faced by individual workers. For those with college and above education (ISCED levels 5–8 together), only 4% of the workers are exposed to a high risk of automation, 61% face a medium risk and 35% are at low risk. The proportion of those at high risk increases as their educational level falls, with the percentage for workers facing a high risk of automation shown as around 27% for high school graduates (ISCED levels 3–4 together), 42% for those who completed middle school (ISCED level 2), and 48% for those who only attended primary school (ISCED level 1). Most of the workers in these countries have a high school or above level of education, although later we will highlight that the quality of education also matters.

Figures 3.6, 3.7 and 3.8 explain why Moldova has the highest proportion of workers at high risk and Georgia has the lowest. More than quarter of the urban workforce in Moldova are employed in elementary occupations, thus having the greatest exposure to automation risk, whereas in Armenia and Georgia nearly half of the workforce are classified as high-skilled workers (i.e. belonging to the top three occupational groups: managers,

professionals and technicians) and hence these countries have a much smaller proportion of workers at high risk from automation. Similarly, in terms of industry, in Moldova almost 20% of the urban labour force are involved in agriculture, fisheries and mining, while in North Macedonia nearly a quarter of urban workers are employed in manufacturing and construction, both of which have the highest risk of automation. By contrast, nearly 70% of the urban workforce in Georgia and Armenia are involved in the other services sector, which has the least exposure to automation risk.

3.5 Discussion of the findings

In their automation analysis of 13 countries (see footnote 8), Khan and Raja (2020) showed that these four countries have a relatively low proportion of urban workers at high risk compared to other developing countries such as Bolivia, Colombia, Ghana and Kenya, where more than a third of urban workers are at high risk from automation. The primary reason for the lower risk in these Eastern European countries is the higher level of education among the workers as well as the greater proportion of workers employed in high-skilled jobs compared to South American or African countries.

Nonetheless, Moldova and North Macedonia still have a significant proportion of workers at high risk (almost 22% and 20% respectively), while Armenia (11%) and Georgia (4%) have a much lower share of jobs at high risk of automation. More importantly, in all four countries nearly two-thirds of workers are at medium risk from automation. By comparison, in other countries in the region (e.g. Poland, Estonia,

Figure 3.8. Risk of automation across education of urban workers in the four countries (job-based approach)

Education level	High	Medium	Low
College and above	3.8	61	35.2
High School	27.1	72.1	0.8
Middle School	41.9	58.1	0
Primary School	47.6	52.4	0
Less than Primary or No education	11.1	88.9	0

■ High ■ Medium ■ Low

Source: World Bank, STEP country survey data.

Slovakia and the Czechia) less than 11 % of the workforce are at high risk from automation[10]. Moreover, the share of workers at low risk from automation is very small in Moldova (15%) and North Macedonia (13%), while this figure rises to 28% in both Georgia and Armenia. These findings have important implications for the future labour markets of these countries.

The results suggest that most of the jobs susceptible to automation in these countries will be in the medium- and low-skill occupations, especially in the agriculture, fisheries and mining as well as manufacturing and construction sectors. Affected workers can either upgrade their skillset and move to relatively high skilled, better paid jobs, or do nothing and accept low-skilled work with less pay in the same or another sector. It would require a closely coordinated effort in these countries at three levels – government, business and individual worker – to help people re-skill/upskill and transition to better jobs. There is a short-, medium- and long-term response to these challenges.

3.5.1 Short-term response
In the short run, both government and businesses in these countries need to be proactively involved in assisting vulnerable workers to transition to new roles and sectors. Policymakers can provide targeted tax incentives to businesses conditioned on retaining their workers and training them for their new roles.

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[10]   See Arntz et al. (2016) for the OECD countries.

Drawing comparisons with other countries, in Germany, for example, the manufacturing sector has adopted robots for production to a much greater extent than the US, but the decline in manufacturing employment has been negligible over the past decade. German firms gave production workers, whose jobs were eliminated by automation, the option of retraining and switching to other supporting roles in the same company (Dauth et al., 2017). This is beneficial for the firm as it does not have to train a new person for the new role; whereas for the worker, although it might lead to some loss in wages, it is preferable to being unemployed. France, on the other hand, has started providing direct annual credit (up to 800 Euros) for every worker that can be used for online or in-class courses to improve their skills. Medium and large firms are also required to contribute to this fund in proportion to the size of their workforce (OECD, 2019). Individuals can choose the training programmes or courses they need to protect themselves against automation.

The workers in the four countries under review here also have to be prepared for reskilling as well as upskilling to remain competitive in the future. Individuals need to realise that it will not be possible for companies to remain competitive and provide guaranteed employment for life unless its workers are willing to regularly update their skills and assume new roles when needed. Firms will have to invest in their workforce to improve productivity, not only for their own business prospects but for the economy as a whole. In this way, a decent pool of skilled workers will always be available in the labour force and thus improve the country's competitiveness.

Figure 3.9. Comparing high-income countries with middle- and low-income countries on enabling environment
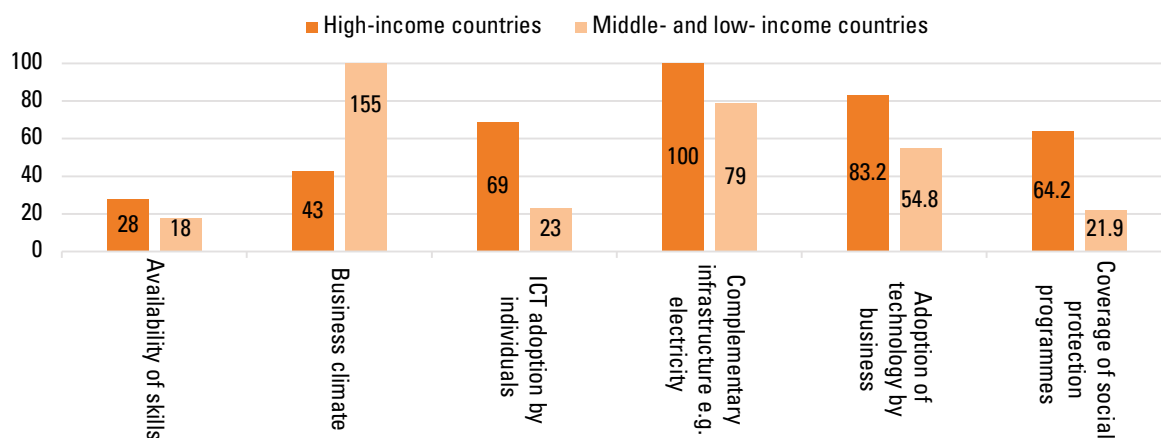
Source: Authors' analysis based on World Bank data, 2016.

3.5.2 Medium-term response

In the medium term, these four countries need to increase digital penetration within firms as well as in the population at large. Figure 3.9 shows the differences in technological adoption and use between high-income, and middle- and low-income countries. The differences in technological adoption and use reflect the countries' divergence in terms of other key socio-economic development indicators, including access to finance, core utilities (e.g. electricity), skills acquisition and social protection schemes. The four countries discussed here need to develop their own ICT sector, not only to provide services to their local customers but also to export IT services to other countries in the region as a way of increasing the relatively low wages in this sector. Moldova, despite having the lowest GDP per capita of these four countries, is a bright spot in this respect. The Moldovan Association of Information and Communication Technologies (ATIC), with the support of the government, established the Tekwill facility in 2015 to train up to 1 000 people a year in ICT technologies. The private ICT sector already makes up about 6% of the country's GDP, primarily through the thousands of freelance workers providing IT services to foreign customers. However, digital technologies have not been widely adopted outside the ICT sector, primarily because of the lack of take-up of new technologies at the individual and company level.

Figure 3.10 shows that in these countries a relatively very small percentage of individuals use the internet to either buy goods or pay their bills. In the modern world firms not only need a website, but they should also be able to market themselves through social media platforms as well as selling on e-commerce websites. The financial sector should offer consumers the opportunity to pay vendors through digital platforms. Once the digital infrastructure is developed, it can provide new opportunities. Taobao villages in China provide an example of a successful public-private partnership, in this case between the World Bank and the Ali Baba group, leading to inclusive development in rural areas using digital services (Qi et al., 2018). These villages have annual e-commerce sales of upwards of RMB 10 million (USD 1.5 million) and at least 100 active online sellers. With the Ali Baba group providing training for vendors in these villages, their number increased from 20 in 2013 to more than 3 200 in 2018. Most of the business owners are women working in e-households, and a significant majority of them have reported themselves to be richer than the average business owner in their community.

An upgraded digital infrastructure will not only improve the efficiency and reach of current businesses, but may also open different sectors and create new kinds of jobs. These improved digital platforms can also be used to help workers enhance their skills in their free time through online courses, as well as providing opportunities to work remotely for some workers with restrictions on their location.

Figure 3.10. Use of digital financial services (% aged 15+)
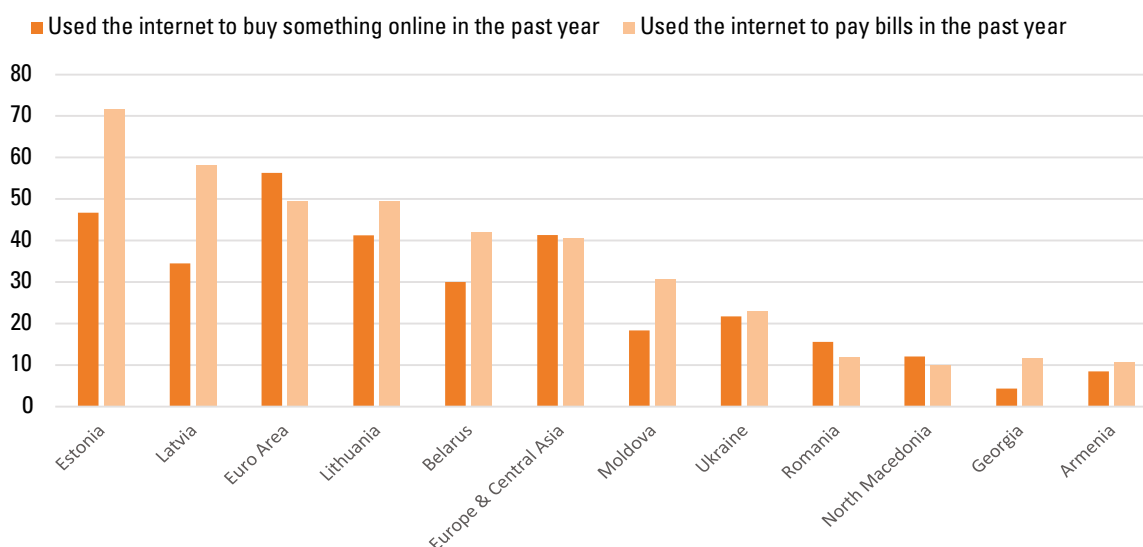
Source: World Bank, Financial Inclusion Index, 2017 data.

Figure 3.11. Learning-adjusted years of expected schooling

■ Expected Years ■ Learning-adjusted years
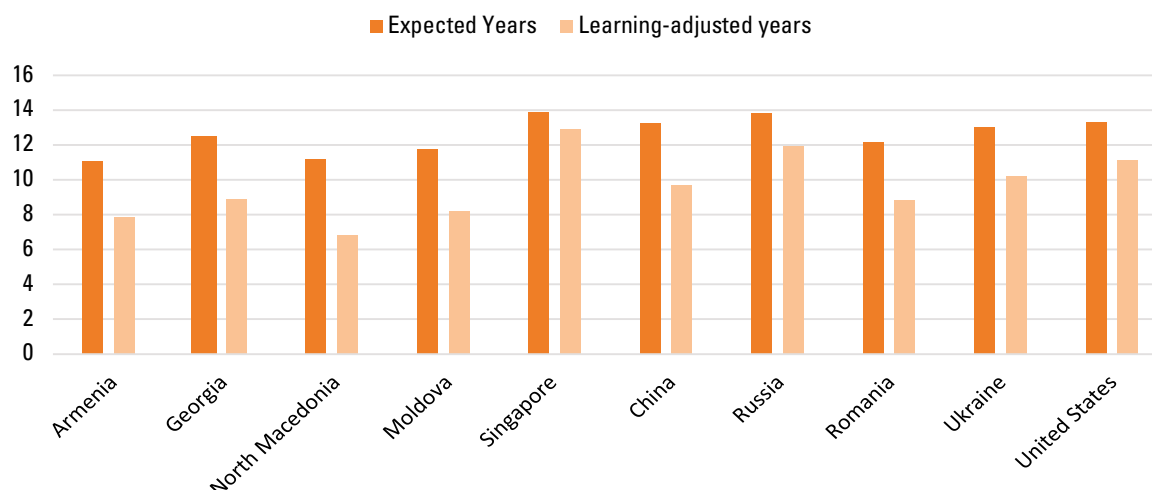
Source: World Bank, Human Capital Index, 2017.

3.5.3 Long-term response

In the long run, these countries need to not only improve the quality of education, but also prepare their workers to take responsibility for learning new skills once they complete their formal education, that is, to develop a habit of life-long learning. However, this would require a complete revamp of the current education system. Figure 3.11 shows that the expected years of schooling in these countries is not very different from advanced countries like Singapore or the US. However, the learning adjusted years of schooling fall by three to four years, suggesting that by improving the quality of education, these students could acquire higher level of skills within the same time span. In addition, students need to be equipped with advanced digital skills and taught how to look for new information as well as learn new skills on their own initiative; for example, if an individual is trained to be an auto-mechanic, she should be able to use the internet to learn about the new models of cars released every few years and how to repair them.

These digital skills need to be complemented with soft skills in areas such as critical thinking, teamwork, communication and presentation, and adaptability. We noticed in the regression results that all the soft skills used at work are negatively correlated with the probability of automation. Many developing countries have realised the importance of digital literacy and have modified the educational curriculum accordingly, but still, in many cases, not enough emphasis is placed on soft skills. Most of the jobs in the future will be concentrated in the services sector, with modern businesses having a global outreach – a profile that highlights the

important role of soft skills in improving companies' competitiveness in world markets.

In the long run, along with improving the skills of the workforce, these countries will also have to invest more in their physical infrastructure. Their relatively high level of education and low wages, as well as their location next to Europe, the biggest economic market in the world, mean that these countries are an ideal place for outsourcing the low- and medium-skill jobs in the European supply chain. However, consistent economic policies (trade as well as fiscal) over the next decade or so are required in order to attract Foreign Direct Investment, alongside improved physical infrastructure to ease the movements of imports as well as exports.

3.6 Conclusions

This article has focused on analysing the impact of automation on the labour markets in Armenia, Georgia, Moldova and North Macedonia. We found that, on average, about 15% of the urban workforce in these countries could be lost to automation, while nearly two-thirds of jobs potentially face significant changes in their task structure over the next two decades. The high risk of automation varies from around 4% in Georgia and 11% in Armenia to about 22% in Moldova and 20% in North Macedonia. Moreover, in all four countries nearly two-thirds of workers are at medium risk of automation. This trend could create a significant negative effect in these countries' labour markets, from job polarisation to increasing income inequality as a result of losing so many of medium-skilled jobs.

The variations between countries regarding the risk of automation stem primarily from differences in patterns of employment and occupational structures within their economic sectors. More than a quarter of the urban workforce in Moldova are employed in elementary occupations, which have the highest exposure to automation risk; whereas in Armenia and Georgia nearly half of the workforce are classified as high-skilled workers (i.e. belong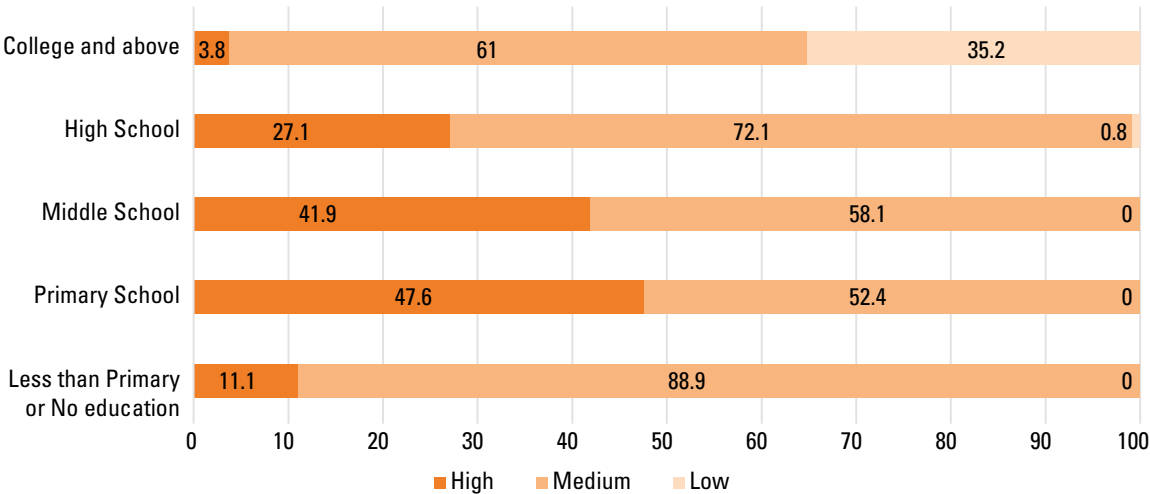ing to the top three occupational groups: managers, professionals and technicians), and hence, a much smaller proportion of workers in these countries are at high risk from automation. Similarly, nearly 20% of the urban workers in Moldova are involved in agriculture, fisheries and mining, while in North Macedonia nearly a quarter of urban workers are employed in manufacturing and construction – the two sectors with the highest risk of automation. By contrast, in Georgia and Armenia nearly 70% of their urban workforce are involved in the other services sector, which has the least exposure to automation risk.

Nevertheless, the results are context-bound, with the analysis showing the 'potential' job losses in the urban areas of the four countries examined and not the 'actual' losses. First, as workers upgrade their skills, the risk of automation will be mitigated. Secondly, although it might be efficient to replace workers with machines in the future, the capital constraints on firms or the limitations in supporting the physical and digital infrastructure in these countries can impose barriers to automation. Beyond individual firms and the business

environment, there are a number of factors that might affect the speed of automation in each country, for example: employment legislation, labour market functioning, industrial relations and business regulations. However, since we live in a globalised world, such resistance to automation would put significant pressure on wages and eventually affect the competitiveness of the economy in the international market.

In the current climate of global competition, less or slower automation might not be the best option. In order to mitigate the risk of automation, coordinated efforts will be required from workers, businesses and the government in these countries to transform this risk into an opportunity by significantly investing in developing human capital as well as building the relevant physical and digital infrastructure. Workers should be equipped with digital as well as soft skills to better protect them against automation. Businesses should enhance their digital presence to improve their market access, and not only invest in their current workforce but also closely coordinate with the government and academic institutions about the type of skills they will need in the near future. Governments should emphasise improving the educational curriculum to respond to changing labour market requirements and provide incentives to businesses to digitise their transactions. The lack of population growth in these countries actually favours the early adoption of automated technologies to improve productivity, but corresponding numbers of skilled workers would be required to operate these machines.

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Annex 1. Description of the variables used in the analysis

Female	Whether the individual is female or not.
Age	Age in years of the individual.
Primary (ISCED level 1)	Primary level of education.
Middle school (ISCED level 2)	Grade 6 to grade 8 or equivalent to basic general in ISCED level of education.
High school (ISCED levels 3 and 4)	Grade 9 to grade 12 or anything above the middle school and less than a Bachelor's degree. It is equivalent to secondary school, post-secondary (specialised or vocational) in ISCED level of education.
College or above (ISCED levels 5–8)	16 years or above level of education. It is equivalent to Bachelor's, Master's, Candidate of Science and Doctorate of Science in ISCED level of education.
Work experience	Dummy variable which is 1 if the individual has worked for at least 6 months for pay since 15 years of age.
Self-employed (last job)	In the last job, whether the individual was self-employed or not.
Part-time job	Dummy variable reporting if the individual is working 25 hours or less in a week.
Requires experience	Dummy variable reporting whether the job requires more than 1 year of experience.
Requires medium education	Dummy variable reporting whether the job requires greater than primary level but lower than Bachelor's degree for work.
Requires higher education	Dummy variable reporting whether the job requires college or higher level of education.
Physically demanding	It varies between 0 and 3: not demanding at all (0); low (1); medium (2); and high (3).
Level of repetitiveness	Varies between 0 and 1. The question asks: 'How often does this job require performing short repetitive tasks?' Not repetitive at all (0); less than half the time (0.33); more than half the time (0.66); and all the time (1).
Autonomy at work	It varies between 0 and 3. The relevant question asks: 'How free were you in deciding how to do your work in your own way, rather than following someone's instruction or some set procedures?' No freedom at all (0); somewhat freedom (1); decent level of freedom (2); and complete freedom (3).
Thinking at work	The relevant question asks: 'How often does this job require tasks that involve at least 30 minutes of thinking?' The response varies from 0 to 3: never (0); less than once a month (1); at least once a week or a month (2); every day (3).
Learning on job	It varies from 0 to 3. The relevant question asks: 'How often does this job require learning new things at work?' Never (0); at least every 2–3 months (1); at least once a week (2); every day (3).
Operates heavy machinery	Dummy variable asking whether the job requires operating any heavy machinery or equipment.
Supervises others	Dummy variable asking whether the job requires supervising other people's work.

Client interaction	Dummy variable asking whether the job requires interacting with clients or anyone else other than co-workers.
Presentation at work	Dummy variable asking whether the individual made any formal presentations to other colleagues or clients.
Basic computing	Dummy variable reporting whether the job requires using basic computing skills like data entry, emails, searching on the internet, spreadsheets, word processing.
Reading level at work	It varies from 0 to 3. It records the level of reading proficiency required at work: not used at all (0); low (1); medium (2); and high (3).
Basic mathematics skills	Dummy variable reporting whether the job requires basic calculations like addition, subtraction, multiplication and division or basic measurement skills.
Advanced mathematics skills	Dummy variable reporting whether the job requires the use of advanced statistical or mathematical skills.
Advanced computation skills	Dummy variable reporting whether the job requires the use of advanced computational skills like Auto CAD, programming skills, advanced accounting software.

ARTICLE 4

THE MACEDONIAN LABOUR MARKET IN STALEMATE: FORECASTING OCCUPATIONAL AND SECTORAL LABOUR DEMAND

Marjan Petreski and Blagica Petreski

This article presents a forecast of sectoral and occupational labour demand in North Macedonia, where the current labour market is in stalemate, experiencing a skill shortage while educational attainment is rising and unemployment is relatively high. A labour demand model is used to forecast sectoral and occupational employment shares for the year 2030, using data from the Labour Force Survey of North Macedonia for the years 2008 to 2017. Results suggest that by 2030 employment in North Macedonia will shift towards occupations and sectors requiring medium and high levels of skill, which is likely to aggravate the current skills shortage. The policy space or, at least, the space for policy discussion, centres around interventions in the education system as a long-term response, as well the redesign or reinforcement of current labour-market policies to reap short-term gains.

4.1 Introduction

North Macedonia is a small country with an official population of just over 2 million inhabitants, roughly half of whom live in the capital, Skopje. The share of the youth population (aged 15–24) is decreasing (from 20% in 2010 to 16% in 2018), mainly due to low fertility rates as well as emigration flows. According to UN Department of Economic and Social Affairs data from 2018, based on country of birth statistics, the emigrant stock from North Macedonia is estimated to be more than half a million (with numbers varying between 534 000 and 626 000) – around 30% of the total population according to the KNOMAD portal[1]. The main destination countries have traditionally been Germany, the US, Turkey, Italy, Switzerland, Australia, Serbia, Austria, Croatia and Slovenia.

Over the last decade, North Macedonia has experienced a constantly improving labour market despite the effects of the global financial crash, the European sovereign-debt crisis and domestic political upheavals. While the activity rate of the 15+ population has remained stable as a percentage of the working-age population (55.7% in 2010 and 57.2% in 2019), the employment rate has increased from 37.9% to 47.3% in the same period. Similarly, the unemployment rate for the 15–74 age group was 17.3% in 2019 (down from 32% in 2010). Even youth unemployment (for those aged 15—24) has decreased, from 53.7% in 2010 to 35.6% in 2019. This improvement is due to several factors, including: an aggressive policy to attract foreign direct investment (FDI), started in 2007; the introduction of popular active labour market policies, including large employment subsidies; greater labour market flexibility; and special support for the creative industries (Petreski, 2018).

Employment by broad economic sectors indicates that the service sector absorbs the majority of total employment in the country (55% in 2019, up from 51.6% in 2015), while almost 14% of total employment was in agriculture in 2019 (down from 18% in 2015). The employment share of the manufacturing sector (including construction) has remained stable, at 31% in 2019 (Eurostat). On the negative side, almost 56% of the working-age population has been either inactive or unemployed in 2019 in North Macedonia. According to Eurostat, the unemployment rate by educational attainment (aged 15–74) indicates a higher unemployment for the low-skilled of 24%, falling to 21% among the medium-skilled, and to 18% among the highly skilled. Those with basic or no education accounted for well over half the inactive population in the country (ETF, 2019).

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[1] The Global Knowledge Partnership on Migration and Development portal, www.knomad.org/data/migration/emigration

Conscious of the need for change, since 2008 the authorities in North Macedonia have prioritised raising the educational attainment of the population, including through compulsory secondary education and vocational education and training (VET). As a result, the educational attainment of the active population (aged 15–74) has been improving: from 2010 to 2018, the share of those with low levels of skills decreased from 27.6% to 19.2%, while the proportion of the highly skilled increased from 18.7% to 24.4% (Eurostat). The largest group is made up of those with a medium level of educational attainment, which increased from 53.7% to 56.4% in this period (Makstat). The medium-skilled includes a substantial share of VET graduates, as the number of students in vocational programmes as a percentage of the total upper secondary pupils (ISCED level 3) has been around 60% for the last decade (Makstat).

Over the same period, the economy has changed, creating new demands for skills. Based on the ISCO-08 occupational categories of employment from the Labour Force Survey data between 2008 and 2018 (Eurostat), the share of the employed population working in low-skilled occupations fell drastically in this period from 25.2% to 13.9%, while the proportion in high-skilled occupations rose slightly from 26.7% to 28.7%. The share of medium-skilled occupations also increased substantially, from 46.7% to 56.7%[2]. The latter trend reflects the creation of new jobs in manufacturing.

Despite these improvements, the labour market's key stumbling block is skills shortage. According to the National Business Confidence Survey of 2019, some 26% of employers in manufacturing, 13% in construction and 20% in trade ranked the shortage of qualified labour as the most significant constraint on their operations; a decade ago most rated it as their least or next to least important problem. Job creation has been significantly constrained by insufficient and inadequate skill supply. However, nearly 20% of unemployed people have a tertiary-level qualification, locking the country's labour market in stalemate: employers cannot find the skills they require despite a wide pool of unemployed people looking for work.

The job vacancy rate in North Macedonia has been stable over the last decade: with the share of available jobs hovering around 1.5%, a little lower that the EU average of 1.9% (ETF, 2019). Job vacancy data show that most of the vacancies are

in construction, the professions, ICT and industry, and are for services and sales workers, technicians and associate professionals, and plant and machine operators. Between 2014 and 2017, the largest increase in labour demand was for services and sales workers, in line with developments elsewhere (ESA, 2017; World Bank, 2016).

This article presents the results of sectoral and occupational labour demand forecast in North Macedonia. It uses quantitative modelling to project the shares of workers that will be needed in different sectoral (NACE[3] Rev. 2) and occupational (ISCO-08) areas. It takes technology, wages and output at the sectoral level, as well as occupational unemployment, as explanatory variables. The study models the long-term relationship between labour demand and its key determinants. After estimating the regression, it uses the coefficients to forecast labour demand in North Macedonia up to 2030.

This innovative study is the first to deal with labour demand in North Macedonia in a convincing way and it provides policy makers with advice for tailoring future education policies (e.g. increasing the attractiveness of VET) and labour market initiatives (e.g. the profiling of recent graduates and other activation measures) to address the current labour-market stalemate. Finally, it identifies and clarifies the factors contributing to the current situation.

Section 4.2 of the article provides a short overview of the evolution of labour market forecasting techniques and briefly reviews some of the literature. Section 4.3 outlines the underlying methodology and data used and Section 4.4 presents the results. Section 4.5 discusses the results in the context of labour market developments in North Macedonia. Section 4.6 concludes and discusses the policy space.

4.2 Approaches to forecasting labour demand

Changing skills have been the subject of forecasting worldwide. Labour economists tend to use model-based, quantitative forecasting methods, while recognising the merits of qualitative methods. Model-based forecasts should be seen as an ongoing process of constant improvement, not

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[2]   Low-skilled occupations are ISCO occupational group 9; medium-skilled occupations are occupational groups 4–8; high-skilled occupations are occupational groups 1–3.

[3]   The Statistical classification of economic activities in the European Community, abbreviated as NACE, is the classification of economic activities in the European Union (EU); the term NACE is derived from the French Nomenclature statistique des activités économiques dans la Communauté européenne.

an ultimate truth. Achieving great precision in forecasting detailed skill needs in different sectors is impossible. However, the models provide useful insights into labour market developments and can give 'forward guidance' to help policy makers develop education and labour market policies in a timely manner.

A typical quantitative model includes a multi-sectoral macroeconomic model with a Keynesian structure, usually built on a Leontief input-output table that takes account of relationships among sectors (Wilson et al., 2004a). Advanced econometric methods are used for forecasting in such models and they have been increasingly upgraded into computable (CGE) or dynamic (DSGE) models (Wilson and Livanos, 2007).

Modelling that estimates reduced-form regressions based on micro-surveys is complex but can produce plausible forecasts for sectoral and occupational employment. Several studies have used quantitative modelling approaches. Briscoe and Wilson (2003) modelled trends in occupations in the UK over the period 1981 to 1999, employing Labour Force Survey data for nine occupations and 17 industrial sectors. Using ordinary least squares (OLS), they regressed the share of employment in each occupation of each industry in total employment using a set of variables including production, wages, unemployment, export and import, a time trend to reflect technology, and dummy variables.

Cörvers and Dupuy (2006) applied a similar approach to the situation in the Netherlands for the period 1983–2003, using systemic dynamic OLS to take account of dependencies among occupations and sectors. They regressed the log of employment in a sector and occupation using value added, capital and R&D expenditures. They concluded that occupational and sectoral employment is determined by both intra- and inter-sectoral/ occupational dynamics.

Bishop and Carter (1991) and Bishop (1998) analysed 13 occupations in the US and, contrary to the other studies, argued that occupational employment follows a logistic growth path and that the logistic function has a ceiling of 20%. Their dependent variable was the log of the ratio between the employment share of an occupation and 0.2 minus that share. This variable is a function of technology, unemployment rate and a set of structural variables.

Many forecasting approaches adopted simpler and/or combined methods. In Cyprus (Oxinos et al., 2005), occupational forecasts are made by applying past occupational shares in total

sector-level employment. In Ireland (Hughes and Fox, 2005), projections consider both past trends and expectations (using expert opinion) for developing skills and occupations. Shares are taken into account for each period and a linear or semi-linear trend is applied. Similarly, in Australia (Meagher, 1997; Meagher et al., 2000), changes in occupational employment shares are considered a technical change and are forecast using historical occupational trends in each industry. In the US (Hecker, 2005), historical movements are reviewed and then factors that might have potentially influenced those changes are identified, using analyses of industries and occupations. Expert assessments are then made of the possible dynamics of these movements in the future, considering factors such as technological change, production and the size of firms. In many countries expert opinions are collected through the Delphi technique, which uses multiple survey rounds to reach a consensus.

One way to forecast future skill needs is to ask employers directly, using labour demand surveys. While popular in many countries, particularly in the 1970s and 1980s, this approach was severely criticised as it lacked theoretical foundations and was based on inconsistent and conflicting assumptions (Wilson et al., 2004b). Since then, such surveys have been used more as a 'nowcasting' rather than a forecasting technique, as documented by Rajan and Pearson (1986).

Attempts have been made to forecast skills in North Macedonia, although the process continues to have its limitations. Few forecasting efforts remain framed within key state institutions, and the results are largely kept for internal use. The main forecasting model, HERMAC, is nested within the Ministry of Labour and Social Policy and aims to provide a long-run forecasting of labour market developments and policy analysis of skill mismatches according to occupations and education. The data is structured in 14 sectors (NACE Rev. 1.1). To the authors' knowledge, the model has been used only internally and no particular official publication has emerged based on it. A forecast of jobs has also been conducted within the Skills Need Analysis of the Employment Service Agency, following NACE Rev. 1.1 and with a horizon of 6–12 months. See ETF (2015) for details of these two forecasting tools.

The Ministry of Education and Science has attempted to establish a Skills Observatory, but progress has been slow. As a preparation for the establishment of the Skills Observatory, Petreski (2016) used a simple forecasting model coupled with the Delphi method, which relies on the

opinions of experts to provide potential pathways for skills needs. Petreski (2017) conducted a forecasting exercise for the employment rate (age range 20–64) in North Macedonia, based on the Cohort Simulation Model, which produced a 4.4 percentage points increase in employment by 2020. While the latter is not a skills-based forecast, modification of the technique could form the basis for such forecasts.

4.3 Methodology and data

The study set up the following model to explain sectoral and occupational employment shares in North Macedonia:

$$S_{ijt} = \alpha + \beta_1 Tech_t + \beta_2 Wages_{it} + \beta_3 Output_{it} + \beta_4 Unemp_{jt} + \varepsilon_{ijt} \qquad (1)$$

Whereby S_{ijt} is the employment share of occupation j in industry i at time t in total employment in time t; is the technology in industry i in occupation j, approximated by a simple time trend; $Wages_{it}$ and $Output_{it}$ refer, respectively, to the logs of wages and production volume in industry i at time t; while $Unemp_{it}$ is the log of the number of unemployed persons in occupation j at time t. For brevity, (1) is the labour demand function.

The model represents a long-run relationship between skills demand and its key determinants. The relation can be made dynamic by including past values of dependent and independent variables.

The model uses data disaggregated by occupation and sector from the Labour Force Survey for the 10 years 2008–17 to make forecasts for the year 2030. Data on wages and production by sector are obtained from the State Statistical Office. The number of unemployed people by occupation is drawn from Eurostat and refers to their previous job.

While the Labour Force Survey is generally of a very high quality and among the oldest surveys conducted in North Macedonia, one must be aware of its limitations, as determined by the sampling framework based on the 2002 Census. As long as the developments since then imply important structural shifts in population, the survey-based results may suffer from a significant bias, and hence, from this viewpoint, caution is needed in interpreting the results. Needless to say, the country should undertake a population census as soon as possible and a new census has been finally scheduled for April 2021.

The model uses a panel estimator of fixed effects by occupation. The dependent variable is the employment in an occupation and sector as a share of total employment and so cannot exceed unity. In statistical terms, it is a limited variable. Van den End et al. (2006) suggest that in such cases transformation into an unlimited variable is desirable, with a logistic transformation: $\ln S_{ijt}/(1-S_{ijt})$. This ensures that the forecasts fall within the [0,1] interval.

The model becomes dynamic by including past values of dependent variables. This approach recognises the likely consistency of the dependent variable as, in most cases, the employment shares of occupations and sectors do not experience large, sudden changes. Hence, the function (1) uses the lagged value of the dependent variable as the explanator and applies the Arellano-Bond (1991) type of estimator to account for potential endogeneity. The method explores many instruments, all possible past values of both the dependent variable and exogenous regressors. The model relies on the system-GMM estimator to use additional information in the levels as sources of exogenous variation. Hansen statistics verify the instruments' validity. The estimated coefficients in (1) are the basis for the forecasts of the skills needed by the Macedonian labour market.

4.4 Results and discussion

4.4.1 Labour demand function

The results of the labour demand model (1) are shown in Table 4.1. The model provides four sets of coefficients: the static model (column 1), the basic dynamic model, which does not consider endogeneity (column 2), the Arellano-Bond type estimation of only the lagged dependent variable (column 3) and the Arellano-Bond type estimation of all variables (column 4). All results are plausible, but have notable differences.

The static model (column 1) suggests that output, wages and unemployment rate are all significant for sectoral and occupational skill demand. When sectoral output increases by 1%, the employment share of the cell [occupation, industry] increases by 0.6%, on average, *ceteris paribus*. Wages are inversely correlated, suggesting that an increase of 1%, reduces employment share by 1.6%, pointing to a potentially strong effect of pricing jobs out of existence.

Significantly, a rise of 1% in unemployed people who worked in the same occupation led to a growth in occupational/sectoral employment share of 0.4%. This is probably related to having an adequately skilled unemployed labour force, enabling demand to be fairly easily matched with supply. The coefficient can be loosely understood as

Table 4.1. Results of the labour demand function estimation

	STATIC MODEL	DYNAMIC MODEL		
		BASIC	ONLY LAGGED DEPENDENT VARIABLE ENDOGENOUS	ALL VARIABLES ENDOGENOUS
	(1)	(2)	(3)	(4)
Lag of the dependent variable		0.319*** (0.054)	0.830*** (0.076)	0.805*** (0.091)
Log of output	0.598*** (0.149)	0.657*** (0.167)	0.0927* (0.048)	0.378*** (0.055)
Log of wages	-1.581*** (0.308)	-0.724 (0.454)	-0.232*** (0.085)	-1.875* (1.115)
Log of number of unemployed	0.408*** (0.117)	0.296*** (0.108)	0.0122 (0.032)	0.335* (0.200)
Trend	0.00244 (0.012)	-0.0184 (0.012)	0.0237*** (0.007)	0.0370** (0.015)
Constant	3.903 (2.930)	-3.295 (4.037)	0.378 (0.763)	13.74 (8.597)
Observations	1209	996	996	996
R-square	0.077	0.137		
Number of id	168	160	160	160
Serial correlation of order 1 – Arellano-Bond test			0.000	0.000
Serial correlation of order 2 – Arellano-Bond test			0.812	0.818
Hansen test – Ho: instruments are valid			0.254	0.567

Notes: *, ** and *** denote statistical significance at the 10, 5 and 1% level, respectively. Estimates are robust to arbitrary heteroscedasticity. The results of the dynamic specification exert a serial correlation of order 1, but not of order 2, which is a requirement for efficient estimates, while the Hansen test has a probability value above 0.15 but well below 1, corroborating the instruments' validity. The coefficient from the static model (column 1) and dynamic model (column 4) is used for the 2030 forecasts.

Source: Authors' calculations.

how easy it is to match skills on the labour market, but it gives no indication of how different markets compare with each other in terms of skill matching. The dynamic model (column 2) largely replicates the results of the static model. The significant lagged dependent variable has a coefficient of 0.319. This does not indicate a substantial persistence of current occupational/sectoral employment shares. Wages are insignificant in this model. The model ignores endogeneity, which may be important depending on the extent of the interdependence of the variables. For example, more output means higher employment, but more jobs also mean more output, which in addition is affected by other factors,

such as global demand – very important for a small, open economy such as North Macedonia.

Column 3 endogenises only the lagged dependent variable, while column 4 endogenises all right-hand-side variables (i.e. logs of output, wages and unemployment). Considering endogeneity brings about important changes. First, the continuation of current sectoral and occupational shares of employment is more likely. Output remains significant, but its effect on sectoral and occupational employment shares dwindles, suggesting that a significant portion of the previously identified effect was the result of a reverse causation or an omitted variable. Wages, as in the static model, are a significant determinant when treated for endogeneity (column 4). Second, occupational unemployment is also important in the case of column 4. The trend is significant in the dynamic specifications, suggesting that technological progress has a positive influence on sectoral and occupational employment.

4.4.2 Forecasting future skills

The forecasts assume that output and wages by sector and unemployment by occupation will grow at the average rate over the period 2008–17. The forecast horizon is 2030.

Figure 4.1 shows labour demand by sectors from the static model. It forecasts job decline in the primary sector (agriculture). The projected expansion of manufacturing suggests that the industrialisation of the country will continue over the long term. Although this growth is slower than expected, it will still account for 22.1% of total employment (15+), an increase of 2.5 percentage points compared to 2017. Employment growth in the trade sector is even more pronounced and is forecast to rise 5.1 percentage points to account for 20% of employment in 2030.

The results of the dynamic model (Figure 4.2) are similar, but more modest. Manufacturing industry is projected to maintain its employment share (from 19.6% in 2017 to 19.7% in 2030), suggesting that

Figure 4.1. 2030 sectoral static forecasts
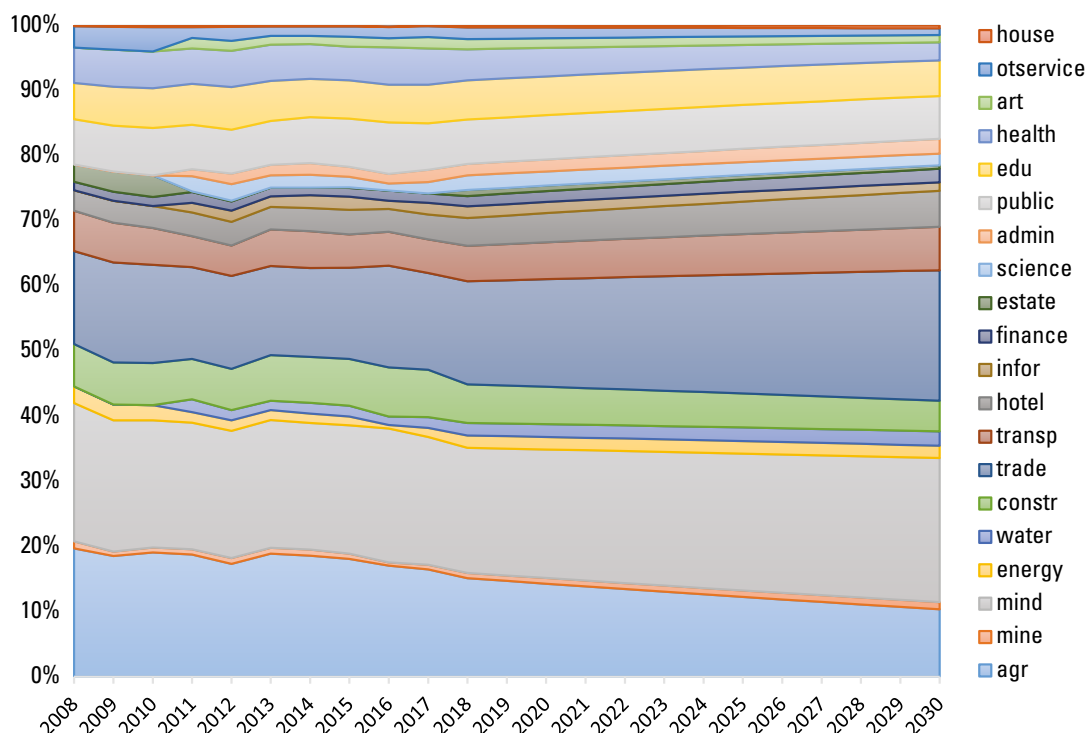
Note: The categories on the graph refer to the broad structure of NACE Rev. 2[4], from A (agr) to T (house). Only category U is not simulated.

Source: Authors' calculations.

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[4]   See: https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF, p. 57.

Figure 4.2. 2030 sectoral dynamic forecasts
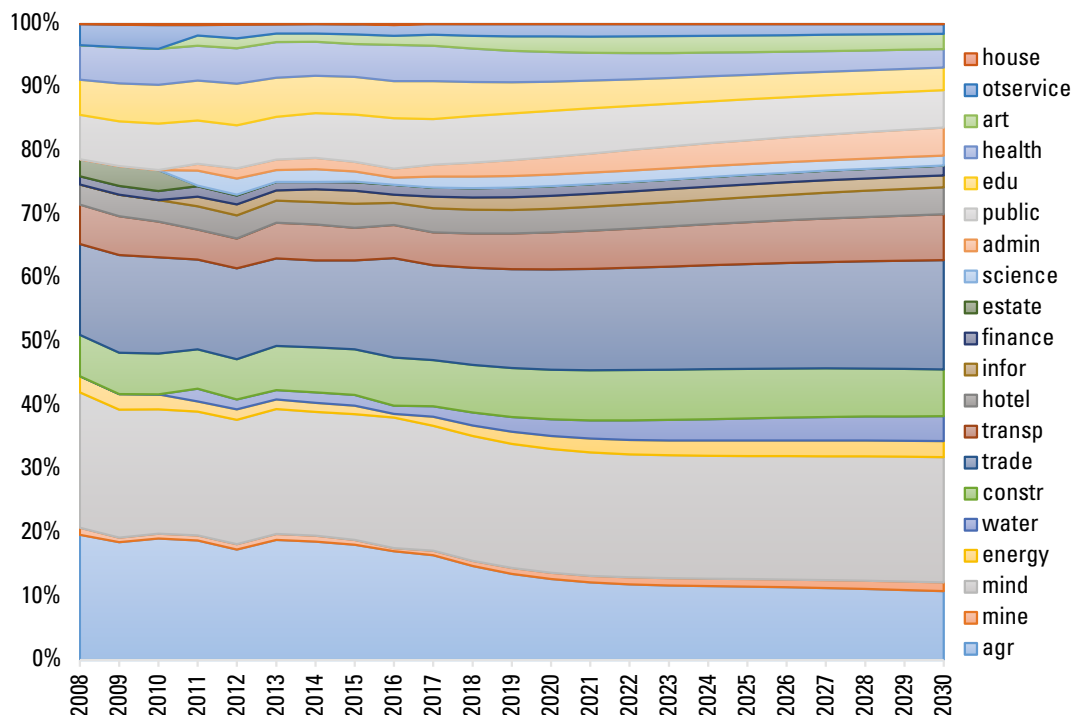
Note: The categories on the graph refer to the broad structure of NACE Rev. 2, from A (agr) to T (house). Only category U is not simulated.

Source: Authors' calculations.

as the economy grows, at least at its potential output growth rate, manufacturing will continue to generate jobs. Employment growth in the trade sector is more modest than in the static model, but still significant, rising from 14.9% in 2017 to 17.2% in 2030.

In both the static and dynamic forecasts, employment in agriculture declines and stabilises in the construction sector. In these forecasts, employment in the public sector also falls, with employment shares consistently reducing in public administration, education, healthcare and social care. This suggests that, over the long run, job creation in the private sector will exceed the public sector, resulting in a more favourable public–private sector employment ratio in line with current reforms.

Figure 4.3 presents skill forecasts from the static model. In the long term, skills are expected to shift upwards. Clerical support workers, sales and services workers are all predicted to increase their share of total employment, while the fall in the number of agricultural workers is pronounced.

The dynamic occupational forecasts suggest a bigger increase in the employment share of medium- and high-skilled jobs (Figure 4.4). Jobs in the executive category are projected to more than double their share of total employment; technical and associate professions are expected to increase by about 50%. The employment share of clerical support workers is predicted to be higher in the dynamic model than in the static model. These developments foresee a significant decline in the employment share of low-skilled occupations.

Figure 4.5 summarises the dynamic model forecasts at five-year intervals. The upper graph gives sectoral employment shares; the lower, occupational ones. The figure clearly shows the expected pace of industrialisation, the growth of services, the decline of jobs in agriculture and fairly stable employment in construction. This is closely correlated with the predicted skill-shift in the country: the demand for low skills is expected to fall rapidly in contrast to the growth in demand for medium and high levels of skill.

In summary, forecasts of labour demand in 2030 suggest that the economy will experience a

Figure 4.3. 2030 occupational static forecasts
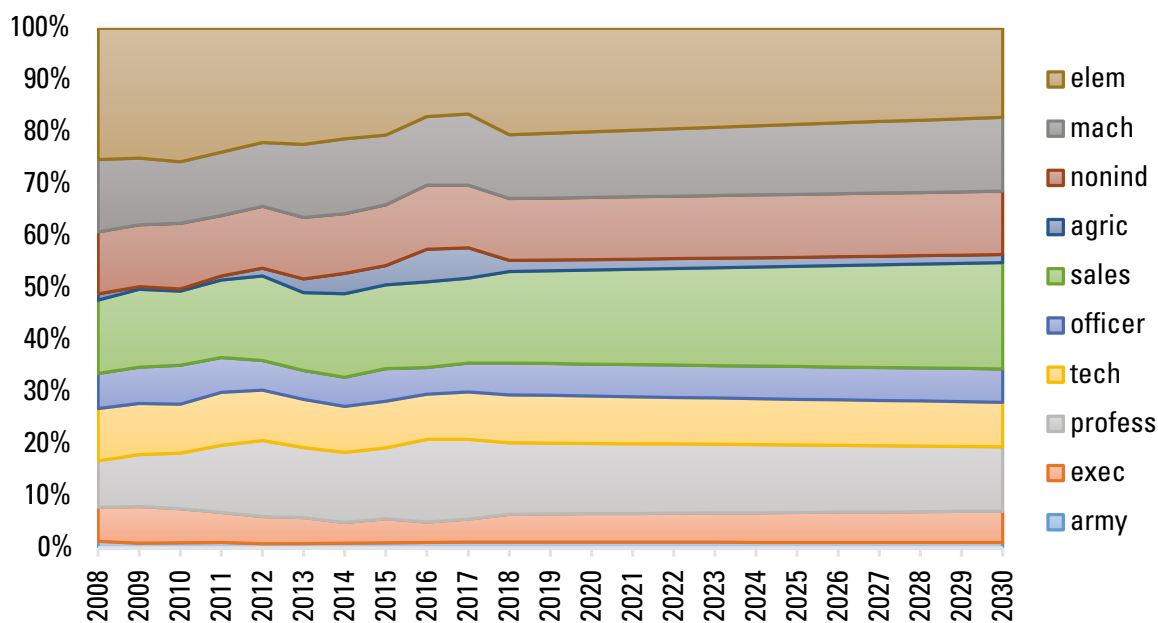
Note: The categories on the graph refer to the major groups of the International Standard Classification of Occupations ISCO-08[5], from 0 (army) to 9 (elem).

Source: Authors' calculations.

Figure 4.4. 2030 occupational dynamic forecasts
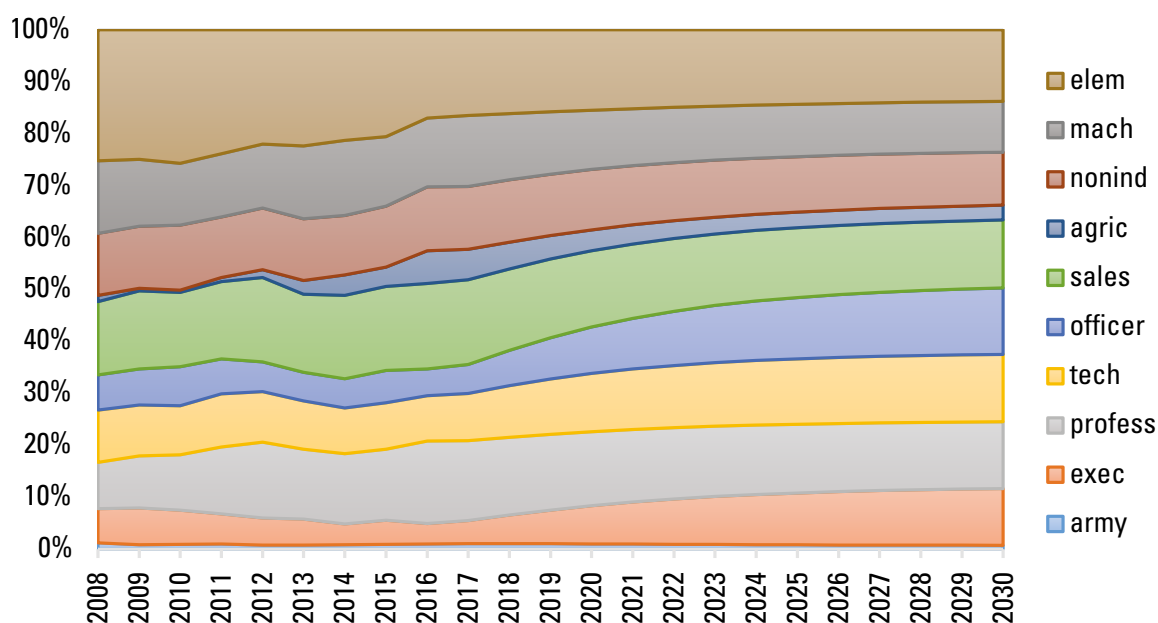
Note: The categories on the graph refer to the major groups of ISCO-08, from 0 (army) to 9 (elem).

Source: Authors' calculations.

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[5]   See: www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_172572.pdf, Table 1, p. 14.

Figure 4.5(a). Five-year summary of sectoral distribution of employment
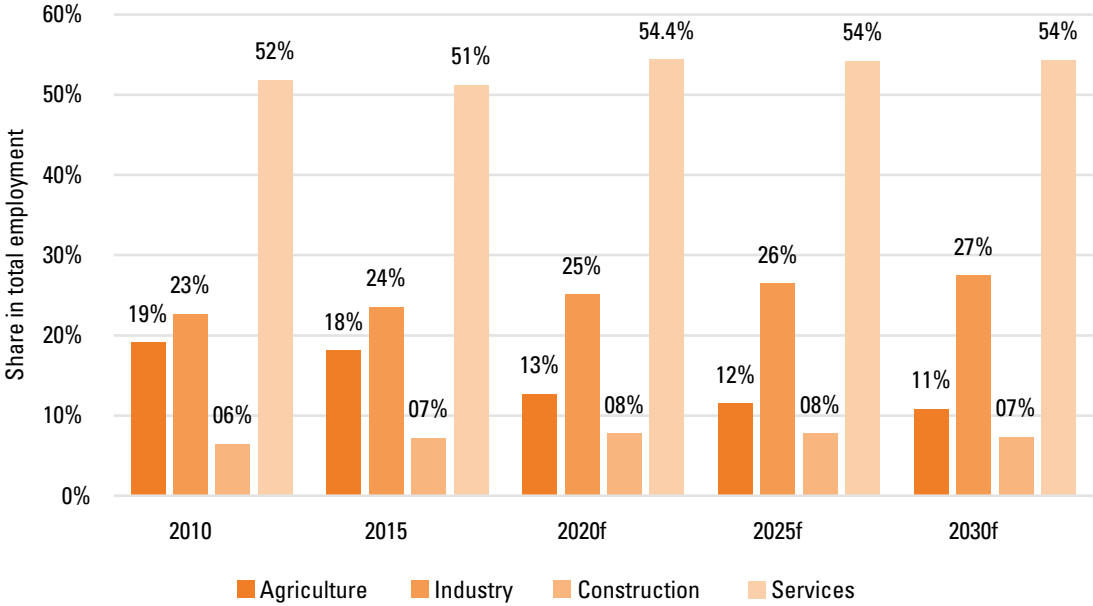
Figure 4.5(b). Five-year summary of skills distribution of employment
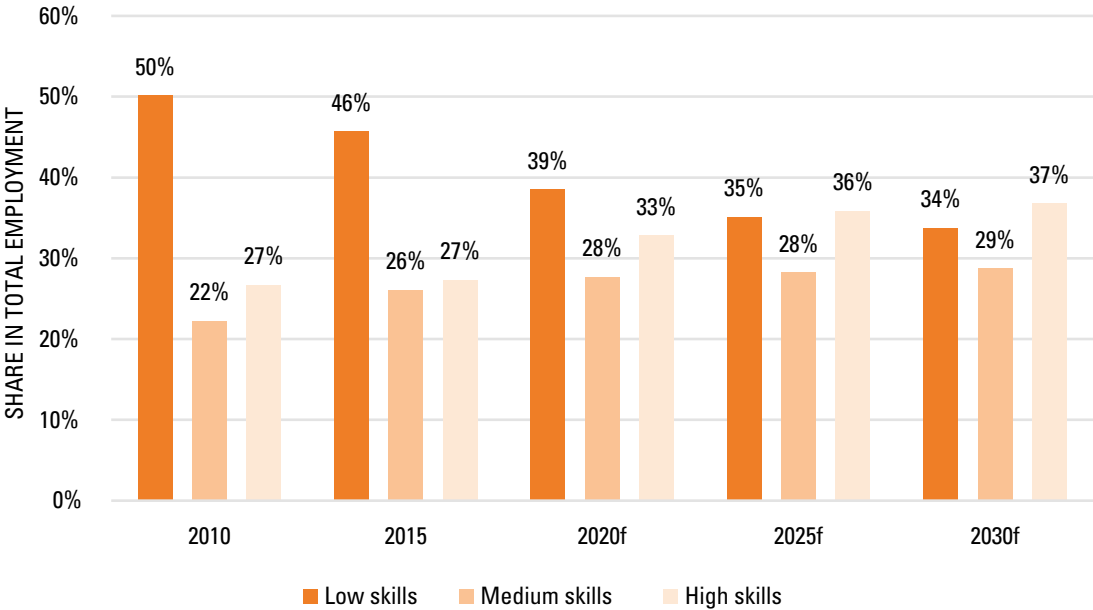
Notes: High skills corresponds to ISCO-08 occupation groups 1–3; medium skills covers occupation groups 4–6; and low skills relates to occupation groups 7–9.

Source: Authors' calculations.

structural shift in employment towards occupations and sectors requiring higher skills than those needed today. While this shift may not be rapid, it will be significant and is aligned with a further moderate industrialisation of the economy and an expansion of the service sector.

4.5 Discussion

The results corroborate previous observations (ETF, 2019) that the demand for medium-level skills is growing in North Macedonia, particularly for administrative staff, associate professionals, and sales and service workers. This forecast reflects current economic trends, and the concomitant skill shortage effects may be aggravated if immediate policy action is not taken. This section discusses these issues.

First, the government has, since 2007, vigorously implemented a strategy to attract FDI, known as 'Invest in Macedonia'. Although the annual share of FDI in employment per year did not exceed the regional average, greenfield investment, which was almost non-existent before 2006, started to flow into the so-called 'technological-industrial development zones', encouraged by generous tax breaks and direct and indirect subsidies. The

automotive sector, which did not previously exist in the country, has benefited most from these measures.

This government initiative brought structural changes to the Macedonian economy. Figure 4.6 shows that after 2009 exports focused on transport equipment, investment products and industrial purchases, while exports of metals and textiles were scaled back (reducing the country's exposure to metal price shocks). While companies in these fields did not locate the highest-technology parts of their value chain in North Macedonia, the technological level established in the country was higher than the previous average and demanded workers with medium-level skills.

Many companies embarked on programmes to retrain the existing labour force in their technological processes. However, limited government efforts to establish and strengthen links between foreign companies in the country and local SMEs, in an attempt to close the large technological gap between them, were started only in 2017 (Trajkovska and Petreski, 2018).

Overall, the economy's restructuring increased demand for medium skills in the labour force, explaining, in part, the current skills shortage. The

Figure 4.6. The changing structure of exports
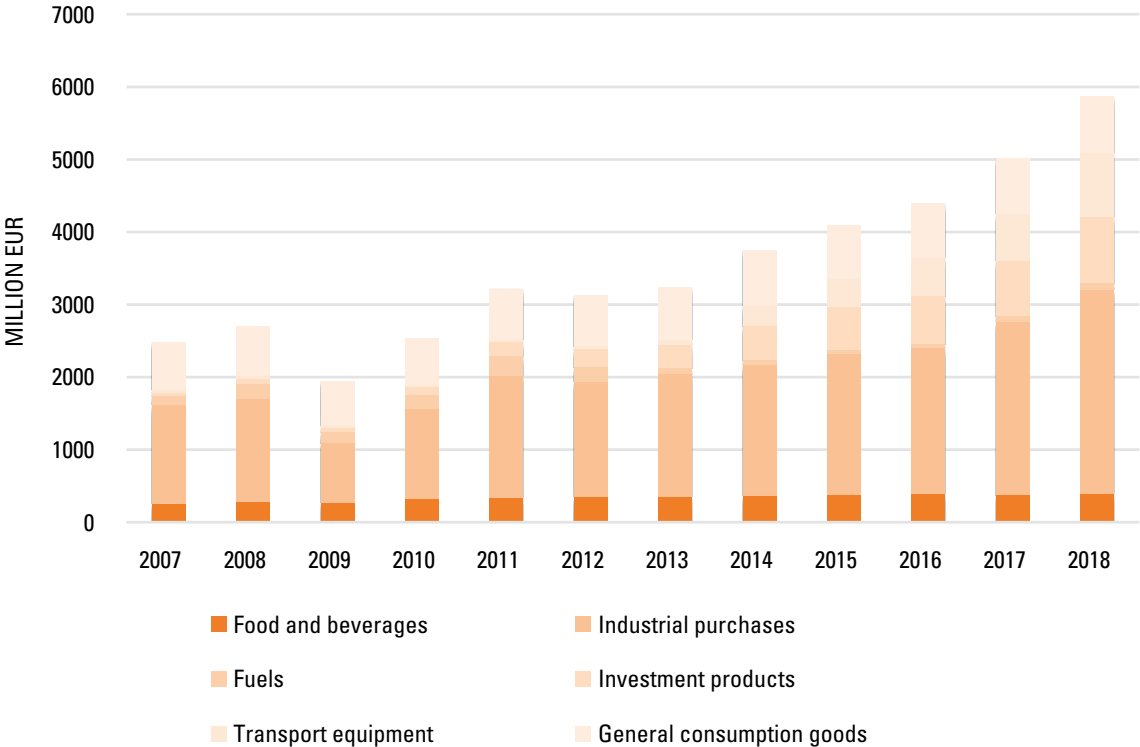
Source: World Development Indicators.

forecast indicates that this will continue, probably increasing the pressure on skills in the medium to long term.

Another factor important for skills development is education. The educational structure of the country's labour force has improved over the last decade, reflecting a growing awareness of the importance of education and the introduction of compulsory secondary education. Access to tertiary education has increased, encouraged by the slogan 'Knowledge is strength, knowledge is power', but this has not been matched by investment in the quality of education. Figure 4.7 shows that the numbers completing tertiary education have increased and there are fewer people with lower educational qualifications, but the number of those with VET qualifications has also fallen, raising concern about investment in diplomas rather than skills.

Educational developments have labour market implications. Petreski et al. (2019b) find that higher educational attainment significantly increases wage expectations in North Macedonia, especially among younger people with short spells of unemployment and a low likelihood of work experience. In contrast, the reservation wage declines with age and longer

periods of unemployment. Petreski et al. reveal that demand has little impact on the reservation wage; this suggests that jobseekers either lack information about local conditions, or, more importantly, are reluctant to adjust their expectations, considering the wage on offer to be substandard. Hence, the reservation wage may be a potential driver of skills mismatch and skills shortage. The study also finds that highly skilled individuals, despite having a positive reservation wage gap, tend to accept market rates below their reservation wage, likely fearing rapid skills erosion.

A number of factors have fuelled emigration: higher educational qualifications, greater wage expectations and the slow creation of better-paid jobs, combined with stagnant social conditions, as well as the EU visa liberalisation with regard to North Macedonia in 2009 and citizens obtaining Bulgarian passports[6]. The World Bank currently estimates an emigration rate of 30–35% of the total population, but this may be an overestimate given the lack of any census data since 2002.

However, such factors imply that the current population estimate of 2.077 million inhabitants and the UN projection of 2.165 million in 2050 remain largely optimistic, from two viewpoints. First, the

Figure 4.7. The changing educational structure of the labour force

SHARES IN TOTAL, %
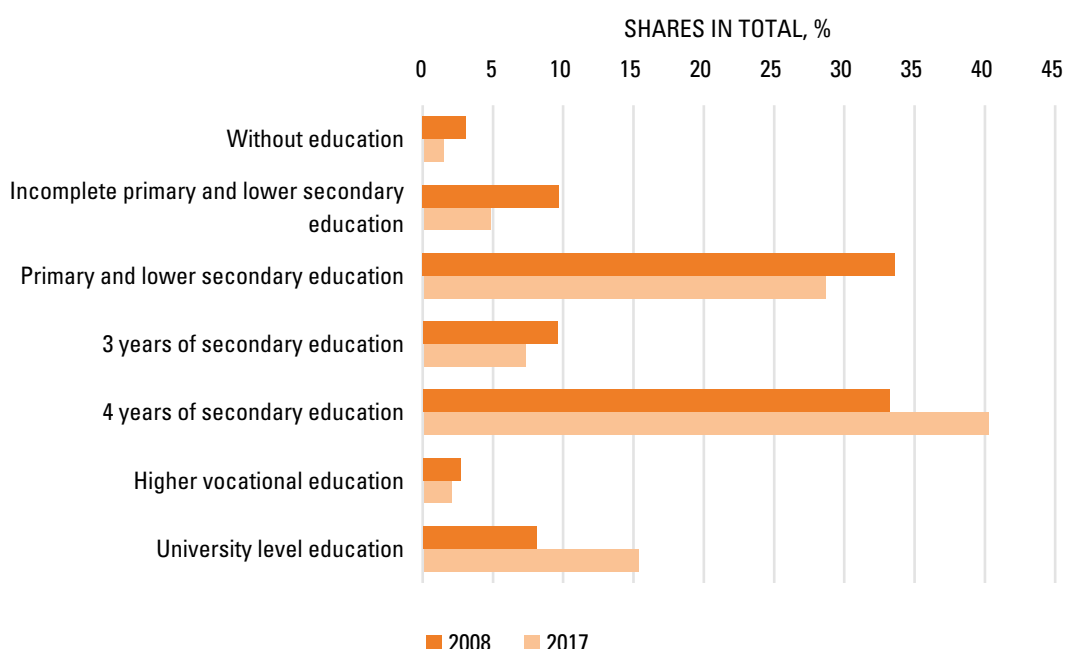
Source: State Statistical Office – Labour Force Survey.

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[6] This refers to requests by Macedonians to obtain Bulgarian citizenship, also implicitly supported by political considerations. Having Bulgarian citizenship makes emigration easier for Macedonians and gives them access to the EU labour market.

2050 projection is based on the current estimate, which takes its data from the 2002 census and does not take into account the recent large waves of emigration. Second, the 2050 projection may have downplayed the changes that emigration has potentially inflicted on fertility rates.

The key question in understanding the population–skills nexus is who is emigrating. Figure 4.8, despite using a relatively old database, suggests that most emigration from North Macedonia to the biggest destination countries, such as Switzerland and Germany, comprises low-skilled workers, but that it also includes a significant proportion of those with medium-level skills. Higher-skilled migrants more often leave Europe.

Articles in the media frequently highlight the 'brain drain' phenomenon[7]. Highly educated individuals and VET graduates present their experience of low salaries and precarious jobs that failed to match their high level of skills, making staying in the country less rewarding. Similarly, the emigration of doctors is widely reported. About half of the country's experienced doctors, nurses and midwives left the country, although the perception is that only highly qualified people leave[8]. This scant, often anecdotal, evidence is another indication of skills shortages.

The current labour market stalemate, which manifests itself as a severe skill shortage despite rising educational attainment and high unemployment, has implications for wages and wage premiums. This is quantitatively confirmed by the significant association between labour demand and wages seen in Table 4.1. North Macedonia is already facing wage pressures, mainly due to the plan to increase the minimum wage, while current research (for example, Petreski et al., 2019a) suggests that wages will bunch around the new minimum with only small increases elsewhere. This represents another paradox: that the 'skill shortage' has little effect on wage premiums. Although beyond the scope of this paper, this topic is an important issue for future research.

Overall, the forecasts suggest that increasing demand for medium and high skills in North

Figure 4.8. Breakdown of emigration by level of skills in selected developed countries
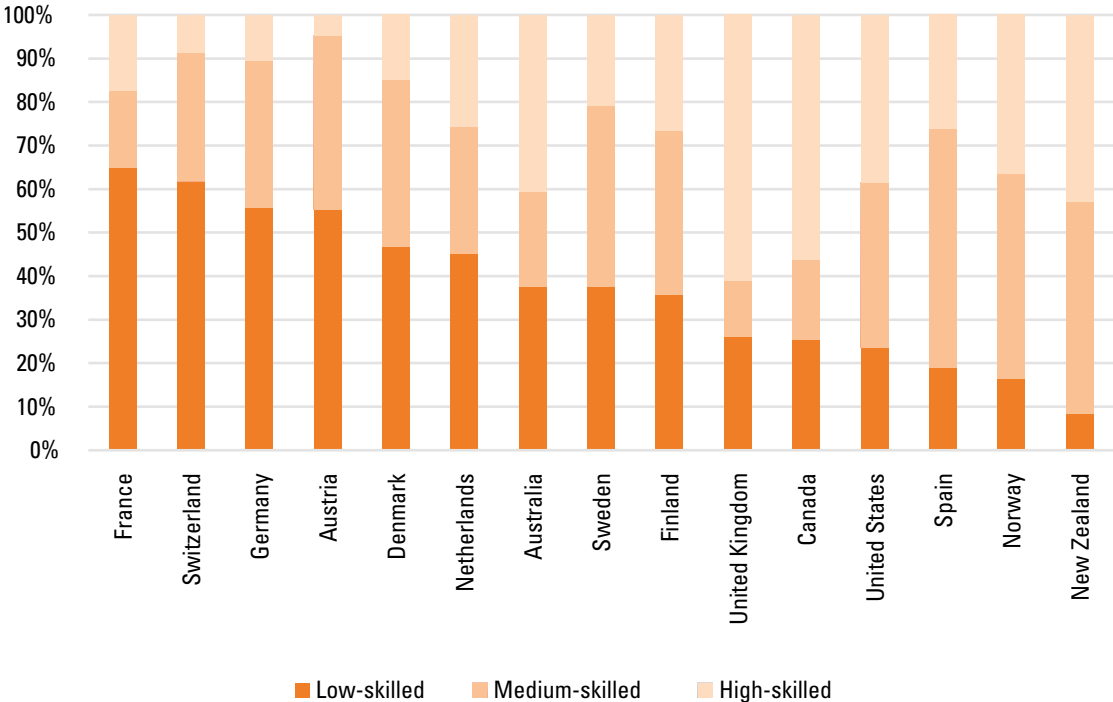
Source: IAB Brain Drain Database (Brucker et al., 2013).

7   For example, see: www.aljazeera.com/ajimpact/north-macedonia-battles-youth-brain-drain-190813151030745.html

8   For example, see: https://kapital.mk/nad-200-lekari-godishno-si-zaminuvaat-od-makedonija-odlivot-na-beli-mantili-ke-zavrshi-so-kolaps-na-makedonskoto-zdravstvo-2/

Macedonia over the medium to long term will exacerbate current skills shortages, which are due to higher demand for medium skills over the past decade, educational policies which for a long time focused on quantity (higher access to education) at the expense of quality (poor outcomes and relevance of education), and high emigration. As these factors continue to increase the skills shortage, prospective demand for higher skills is unlikely to be met, reducing the economy's potential for growth.

4.6 Conclusion

This article presents the forecast of sectoral and occupational labour demand in North Macedonia for 2030 and considers these requirements in the context of current labour market developments. The forecasts use a static and dynamic labour demand model to project sectoral and occupational employment shares for 2030, using data from the Labour Force Survey of North Macedonia for the period 2008–17. This forecasting provides a further contribution to the existing methods/tools used for skills anticipation in North Macedonia with a longer perspective. It may provide a solid basis for policy planning and for keeping abreast of future developments in work, such as the typology of jobs and labour market patterns, and could become a regular exercise nested within the Ministry of Labour and Social Policy. It is however important to update the exercise regularly to capture any changes, as the impact of the current global health crisis has made very clear.

The forecasts suggest that by 2030 the economy will see a structural shift in employment towards occupations and sectors requiring more medium- and higher-level skills than those needed today. The shift may not be rapid, but it will be significant and is aligned with a further moderate industrialisation of the economy and an expansion of the service sector.

Such results are contingent on the continuation of the current industrial developments, predominantly supported by the introduction of FDIs into the country – a trend that started in the late 2010s – as well on the changing educational structure of the

labour force towards higher educational degrees. However, educational policies, emigration trends and the high wage expectations especially of young people, along with the restructuring of the economy, have determined the current skills shortage. The projected increasing demand for medium-level skills will determine the prospective skills shortage on the labour market.

The current labour market stalemate is complex. It has accumulated over time, poses considerable risks for North Macedonia and cannot be resolved quickly. However, the space for policy intervention or, at least, further discussion, may be created.

Without doubt, in the longer term, the situation requires heavy investment to improve the quality of education and a focus on developing an attractive and relevant vocational education and training (VET) sector. This may be accompanied with awareness-raising campaigns highlighting that skills rather than diplomas are needed, and that VET can lead to a more productive and equally well-paid job as a university diploma. The business community has opened up the question of importing labour into the country. However, North Macedonia has an unemployed rate of 16.6% and wages above the minimum wage are sticky. Importing labour – assuming North Macedonia could attract it – may only weaken government efforts to reduce persistently high unemployment and inactivity, as well undermining any plans to increase wages.

Given the large proportion of people with low educational attainment, particularly among those who are unemployed and inactive, policy options in the short run also require drastic measures for those adults who are already of working age. These may include remedial education measures for the low-educated (i.e. second-chance education programmes), as well as the more efficient use of active labour market policies, such as short training or retraining courses to requalify workers and equip them with the (medium-level) skills needed in the labour market. In conclusion, adult education and training measures within a lifelong learning perspective seem as important as long-term improvements in the initial education and VET sectors in North Macedonia.

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ARTICLE 5
MAPPING THE FUTURE OF 'AT-RISK' JOBS: A CASE STUDY FOR ISTANBUL AND NORTH MACEDONIA

Cornelia Suta, Michael Cross, Mike May-Gillings and Fraser Harper

There are many studies that highlight the tendency to automate routine tasks, the growing polarisation between low- and high-skilled jobs, and the rising demand for cognitive skills in rich economies, but little research has been carried out at the regional level in middle-income countries. We fill this gap with a task- and skills-based analysis of the current and future demand for skills in two regions: Istanbul and North Macedonia. This article explores a new approach to identifying the jobs that are most 'at risk' of automation, as well as those that are less automatable (and so 'safe') and which 'at-risk' workers may feasibly move to instead. The employment data for Istanbul and North Macedonia by sector, occupational group and education level come from Eurostat regional statistics and the Cedefop 2018 Skills Forecast database. In this new regional approach, first, jobs that are 'at risk' based on current trends in technology innovation are identified, together with 'safe' jobs. Then, an analysis is undertaken of which 'safe' jobs those whose jobs are at risk may feasibly move to. The study shows that the transition could be relatively easy for some occupations, but substantial training might be needed for others. The results can be used to inform policy makers in Istanbul and North Macedonia, thus helping them to develop policies that will improve the resilience of the workforce to changes in technology, notably through training. The methodology for finding suitable occupations for 'at-risk' workers to move into could be applied to a wide range of threats to jobs where the type of occupation is a key risk factor, including the impact of Covid-19.

5.1 Introduction

While many studies highlight the tendency to automate routine tasks, the growing polarisation between low-and high-skilled jobs, and the rising demand for cognitive skills in advanced economies, very little research has been done at the regional level (OECD, 2018a) in middle-income countries. We aim to fill this gap with a task- and skills-based analysis of the current and future demand for skills in Istanbul and North Macedonia[1]. The objective of this research is to trial a new approach for identifying, at regional level, the jobs that are most 'at risk' of automation as well as those that are less automatable (and so 'safe') and which 'at-risk' workers may feasibly move to instead.

In the US, the share of high-skilled jobs in total employment declined over the period 2000–12, driven by a relative decline in the number of STEM jobs (e.g. biological scientists, physical scientists, (all) engineers), which require high maths proficiency but low social skills. Other cognitive occupations, requiring significant social skills, such as managers, teachers, nurses, therapists, physicians and lawyers, experienced a much faster expansion in the same period (Deming, 2017). The skills and tasks that cannot be automated are generally complemented by technology, while jobs requiring social skills show the fastest growth (Ibid.) and command higher wages (Deming, 2017; Deming and Kahn, 2018). Firms are increasingly demanding higher levels of cognitive and social skills from their employees (Deming and Kahn, 2018).

The figures from the OECD Skills for Jobs[2] database confirm that the shift towards a knowledge-based digital economy is already underway, that skill requirements have gradually moved towards a more intensive use of cognitive and interpersonal skills, and that high-skilled occupations are in strong

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[1] The regions were chosen based on the availability of data from Eurostat and the Cedefop Skills Forecast.

[2] www.oecdskillsforjobsdatabase.org/

demand across most OECD countries (OECD, 2018b). Having good levels of literacy, numeracy and problem-solving skills in technology-rich environments provides the key to unlocking the benefits of the internet (OECD, 2019).

An additional major resource in understanding the changing nature of occupations is the US occupation information database known as O*NET (National Centre for O*NET Development, 2020). Currently the most comprehensive[3] database on tasks and skills by occupation, it is used by many researchers (see Gorka et al., 2017; Hillage and Cross, 2015; Rohrbach-Schmidt and Tiemann, 2013).

O*NET data are organised according to the US occupational classification, which does not fully correspond with the International Labour Organisation's (ILO) International Standard Classification of Occupations (ISCO). Gorka et al. (2017) matched the O*NET information related to job content with individual occupational data from the European Union's Labour Force Survey (EU-LFS) to construct five task-content measures: non-routine cognitive analytical; non-routine cognitive interpersonal; routine cognitive; routine manual; and non-routine manual physical. Over the period 1998–2014, the non-routine cognitive content of jobs increased in all EU-28 countries, while the manual content decreased. The routine cognitive content of jobs fell in the majority of EU-15 countries, but it rose in most of the Central and Eastern European Member States of the EU, as well as in Portugal and Greece. Gorka et al. (2017) attribute these variations to different patterns of structural change.

Dicarlo et al. (2016) argue that O*NET should not be used for analysing tasks in developing countries because, since the data are collected for the US, the assumption that the job content of occupations is constant across countries and identical to that of the US might be too strong. We argue that globalisation has brought about a transfer of technology from developed countries to developing countries through supply chains. This transfer of technology has led to changes in the content of jobs in developing countries, creating similarities with those jobs relocated from developed countries. In fact, the current wave of globalisation can be characterised by the combination of high-tech capital and low-skill labour, which has made the relocation of production from developed to developing

countries possible. In order to use the technology, workers in developing countries have had to adapt their way of working and undergo specific training. The newest technologies, such as artificial intelligence (AI) and robotics, are expected to bring gains in terms of high productivity that could lead to a faster transfer of technology between countries[4]. This is even more likely to happen in the case of services, as technology transfer takes place faster with software and digital technology than with robotics or machinery[5]. Moreover, there is a default international standard for many occupations, including logistics, oil and gas extraction, and medicine. This argument supports the application of O*NET to middle-income regions such as Istanbul and North Macedonia.

Considering the EU's strong commitment to tackling climate change, as set out in the Green Deal (European Commission, 2019), the adoption of technologies to reduce emissions and increase energy efficiency might increase the pace of implementation with respect to particular types of automation. Part of the ambition is to ensure that EU trading partners also take action on climate change by strengthening the enforcement of sustainability commitments in trade agreements. Moreover, the EU aims to set up a Green Agenda for the Western Balkans, mirroring the Green Deal, and thereby establishing environment, energy and climate partnerships with the Eastern Partnership and Southern Neighbourhood. In this context, therefore, using the O*NET database to analyse which jobs are 'at risk' and assess the possible movement of workers towards 'safer' occupations is a useful exercise. Furthermore, this research is expected to inform the decisions of policy makers in Istanbul and North Macedonia with regard to retraining the current and future workforce.

Much has been written in recent years about the impact of automation on labour markets. According to Frank et al. (2019) any assessment of the effects of AI and automation on the future of work faces several barriers, including: a lack of high-quality data about the nature of jobs (e.g. the dynamic requirements of occupations); a lack of empirically informed models of key micro-level processes

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[3] O*NET covers nearly 1 000 occupations and captures over 270 different variables for each one, such as skills, abilities, knowledge, work activities and interests associated with occupations.

[4] Both North Macedonia and Turkey demonstrate a relatively high participation in global value chains (ETF, 2018, 2019) and therefore are expected to gain from the transfer of new technology via the supply chain.

[5] It is true that the cost of AI is often still sufficiently high to prevent rapid uptake by many small and medium-sized enterprises (SMEs). However, if the productivity gains might compensate for the investment cost, especially if there is a shortage of labour in the occupation as well as rising labour costs, SMEs are more likely to invest in that AI.

(e.g. skills substitution and human-machine complementarity); and an insufficient understanding of how cognitive technologies interact with broader economic dynamics and institutional mechanisms (e.g. urban migration and international trade policy). To capture the dynamic requirements of occupations and the suitability of tasks for machine learning, Fleming et al. (2019) analysed 170 million online job postings in the US between 2010 and 2017 and found that there are a small number of occupations (fewer than 50) with a high proportion (more than 80%) of tasks suitable for machine learning. At the same time, there are a much larger number of occupations (around 700) with a small proportion of tasks (less than 20%) suitable for machine learning.

In the literature, analysis of the future risk of automation varies, but most methodologies are based on an assessment of task or skills content. Historically, the adoption of new technologies has changed the demand for a number of occupations in the economy. The new rapid advances in technology, particularly in automation and AI, are expected to have a huge effect on the labour market, but there are many uncertainties and the scale of the impact is difficult to estimate. The change in demand for some occupations is clearly linked to how many of the tasks involved may be automatable (OECD, 2019). Workers whose jobs entail many such tasks may need to change occupations to remain in employment, requiring them to adapt their skill sets and perhaps acquire new skills and knowledge.

Given the fundamental uncertainty in predicting technological change, Frank et al. (2019) recommend the development of a framework to help the transition of workers that focuses on their economic resilience, and in this study, we undertake that task. We first identify job profiles that are 'at risk' of automation, based on current trends in technological innovation, before presenting a methodology to link the workers in those jobs to jobs with a 'safer' profile and suggesting a pathway for making such a transition.

The methodology for finding suitable occupations for 'at-risk' workers to move into, described in Section 5.2.2 below, could be applied to a wide range of threats to jobs where the type of occupation is a key risk factor, including the impact of Covid-19.

5.2 Data and methodology of the research

This article uses a regional approach to identifying the jobs that are most 'at risk' of automation and those that are less automatable ('safe'). For this

analysis, Istanbul and North Macedonia were selected because suitable data are available from Eurostat and the Cedefop Skills Forecast. The Eurostat nomenclature of territorial units for statistics (NUTS) was used to identify the two socio-economic regions of Istanbul and North Macedonia[6]. Although the size of their populations is quite different (with Istanbul having 15.5 million inhabitants and North Macedonia just over 2 million), both have the territorial classifications of NUTS1 and NUTS2. Given the population level of North Macedonia, the country as a whole was considered for both the first (NUTS1) and second (NUTS2) level of territorial statistical unit. In the case of Istanbul, the NUTS2 level of regions was used[7].

This new regional analysis, which combines two methodologies, used the employment data of Istanbul and North Macedonia by sector, occupational group and education level. The data for Istanbul and North Macedonia were drawn from Eurostat regional statistics (Eurostat, 2020a, 2020b) and the Cedefop 2018 Skills Forecast database (Cedefop, 2020). The employment data in the Eurostat regional statistics are available only by broad NACE sector levels, thus limiting the analysis. To provide a better understanding of the changes that automation might bring, this data was complemented with Cedefop 2018 Skills Forecast data, which is available for two-digit ISCO-08 occupations.

Given the availability of country-level data by sector and occupation, the analysis was quite straightforward in the case of North Macedonia. For Istanbul, however, the employment data in the Eurostat regional statistics were not available both in terms of sector and occupation. Therefore, this breakdown was estimated by using employment data by sector for Istanbul and Turkey from Eurostat, and employment data by sector and occupation

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[6] The nomenclature of territorial units for statistics (NUTS) is a geocode standard for referencing the subdivisions of countries for statistical purposes, developed and regulated by Eurostat for the EU Member States. It is also used in the EU candidate countries. The NUTS classification is mostly based on an administrative (institutional) breakdown of territorial units for practical reasons (the availability of data and the enforcement of regional policies). Specific guidelines are based on population, leaving little role for other types of variables. It is a hierarchical classification divided into three levels based on average population size: the first level is NUTS1 (3–7 million), the second level is NUTS2 (800 000–3 million) and the third level is NUTS3 (150 000–800 000).

[7] Turkey has 12 NUTS1 regions, 26 NUTS2 sub-regions and 81 NUTS3 provinces. Istanbul is at the same time classified as NUTS1 Istanbul region (TR1), NUTS2 Istanbul sub-region (TR10) and NUTS3 Istanbul province (TR100). North Macedonia has one NUTS1 region, one NUTS2 sub-region and eight NUTS3 territories. See Eurostat.

for Turkey from the Cedefop 2018 Skills Forecast. Drawing on the Eurostat data, the shares of employment by sector in Istanbul compared to Turkey as a whole were applied to the Cedefop 2018 Skills Forecast. The newly estimated time series of employment by occupation and sector for Istanbul were therefore constructed by assuming that the occupational structure in each broad sector in Istanbul is the same as in the country as a whole.

Having set the regional focus of the analysis and the main data sources used, this section presents the two methodologies that were employed in the analysis in order to identify both automatable jobs (Section 5.2.1) and possible alternative jobs (career changes) for those 'at risk' of automation (Section 5.2.2).

5.2.1 Profiles for jobs 'at risk' of automation

The occupation classification is a way of grouping jobs together based on the similarity of their requirements in terms of tasks, skills and knowledge. In this study we define a job as 'a particular occupation in a particular sector', noting that broadly similar occupations can have different requirements (e.g. various combinations of tasks, skills and knowledge) in different sectors. We use the term job profile to refer to and emphasise these divergent task and skill requirements, and generally to differentiate between the jobs that are estimated to be 'at risk' of automation (due to the tasks required) and those that are deemed to be 'safe'. In a broader sense, we use the terms job, job profile and occupation interchangeably.

What makes a job automatable? Autor and Dorn (2013) identified that the adoption of information technology coincided with the displacement of labour from routine tasks in most sectors. McKinsey (2017) found that, in almost all occupations, certain categories of activity, such as processing or collecting data, or performing physical activities and operating machinery in a predictable environment, have a high technical potential for automation. Depending on the importance of these activities within an occupation, some jobs could be fully automated by adapting current technologies. Josten and Lordan (2019) identified those jobs that will be automatable in the next decade where a technology is being actively developed (i.e. there is extensive patent activity) to substitute for that occupation (measured at the three-digit level[8]).

As a result, Josten and Lordan's analysis ultimately pinpointed fully automatable occupations, while other authors talk about a decrease in demand for occupations where only part of the job is or will be automatable.

In this study, we use the list of automatable, fully-automatable and polarised-automatable occupations from Josten and Lordan (2019), which is based on the current development of new technologies that could in the future replace human workers. The methodology used to create this list can be found in Josten and Lordan (2019). The definition of an automatable job is taken from Autor and Dorn (2013), that is, a job with high levels of routine tasks and low levels of manual and abstract tasks. Examples of automatable jobs are assemblers of electrical equipment and metal platers. A *fully* automatable job is one where technology is at a stage of development such that it may become a viable substitute for a particular job (Josten and Lordan, 2019). These include jobs such as truck drivers, accountants and auditors, legal assistants and paralegals. In the case of *polarised automatable* jobs, patent technology has had some success, but these occupations also require interpersonal interaction, with a predictable sequence of events. Therefore, the adoption of these technologies will result in polarisation, with human workers still needed where a personal interaction holds real value but robots being used where this is not the case (Josten and Lordan, 2019). Examples of such jobs include waiters and waitresses, bartenders and lawyers.

We have chosen the list from Josten and Lordan (2019) since most of the literature considers that technology *could* replace workers in the performance of some automatable aspects of a job, such as routine tasks. Josten and Lordan (2019) define a job as automatable where technology is already at a particular stage of development (e.g. at the patent stage) and is a viable substitute for a particular job. This list is not specific to any region or country so it can be used to perform similar analysis for any location.

The purpose of this study is not to estimate the total number of jobs 'at risk', but to identify those workers that might require retraining to move to a safer job, and to ascertain exactly what those safer jobs might be. In some cases, workers could move from 'at-risk' to 'safe' jobs with little effort, as some of the 'safe' jobs have similar skills requirements. In other cases, it is not so easy to identify suitable 'safe' jobs that workers could move to. This is illustrated in Sections 5.3.3 and 5.3.4 below. First, however, we describe the methodology used to identify possible career changes.

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[8] The ISCO classification of occupations has different levels of aggregation, using one-digit codes for the most aggregated and moving down through two- and three-digit codes to four-digit codes for the most disaggregated (detailed) level.

5.2.2 Identifying possible career changes

In this section we describe how career change matrices, skill complementarities and job zones are applied to the Josten and Lordan (2019) categorisation of occupations to provide a robust list of career change options.

First, the O*NET Career Changers Matrix is used, which links similar occupations in terms of how 'easy' it is for people to move between them (HumRRO, 2012; National Centre for O*NET Development, 2012). For each occupation, the matrix lists the 10 most closely matching occupations based on work content. The O*NET Career Changers Matrix is combined with the Josten and Lordan (2019) classification of automatable jobs to ensure that any career change is steered towards occupations that are not also at risk of significant automation.

In order to refine the matches further, we draw on the work of Lazear (2009), Muro and Liu (2017) and Alabdulkareem et al. (2018) to identify sets of occupational attributes and work content (hereafter collectively referred to as occupational *elements*) that co-occur across occupations and represent key occupational features. This is referred to as 'skill complementarity'. For highly skilled occupations, this co-occurrence can be used to identify how sets of elements – for example, problem-solving and decision-making as a skill pair – support each other, either because they combine effectively to boost productivity or because it is relatively easy to acquire and master both skills. For potentially automatable occupations, co-occurrence can also be used to identify sets of elements that contribute to the automation and non-automation potential of the occupation.

Finally, the amount of preparation required for each occupation is taken into consideration to identify the ease with which a worker might move between jobs. The O*NET database shows occupations' 'job zones'. In O*NET, a job zone is a group of similar occupations in relation to a number of factors: the level of education people need to do the work; how much related experience is required; and the extent to which on-the-job training is necessary. Job zones are rated on a scale of 1 to 5, with job zone 1 occupations classed as needing little or no preparation and those in job zone 5 as requiring extensive preparation.

The methodological steps explained above can be applied to any region or job, but the scope needs to be narrowed to make any particular study manageable. Here the focus is on jobs found to be important in Istanbul and North Macedonia.

5.3 Application of methodology and main findings

This section presents the results of the two levels of analysis. Section 5.3.1 discusses labour market data for Istanbul and North Macedonia, including a high-level analysis of jobs 'at risk' of automation. Section 5.3.2 presents and discusses the transition matrix approach to identifying possible jobs that workers in 'at-risk' occupations could move into. While Section 5.3.3 shows how additional data can be used to improve the analysis, and provides an example for a particular occupation in North Macedonia, Section 5.3.4 provides an example for Istanbul which suggests that finding a suitable occupation to move to may be difficult.

5.3.1 Regional analysis of jobs 'at risk' of automation

As mentioned previously, our analysis uses data for Istanbul and North Macedonia taken from Eurostat regional statistics (Eurostat, 2020a, 2020b) and the Cedefop 2018 Skills Forecast (Cedefop, 2020). For both regions, we constructed employment data by occupation and sector (see Section 5.2 for details of the data construction). This section explains how the methodology described in Section 5.2.1 was used to shed light on the 'at-risk' jobs.

The list of occupations compiled by Josten and Lordan (2019) is based on the three-digit occupations found in the *US Dictionary of Occupational Titles*. Our main sources of data on employment in Istanbul and North Macedonia are based on the one- and two-digit level of ISCO-08 occupations. First, we created a correspondence table between the US occupation titles and the four-digit ISCO-08 occupations, obtaining a list of 'at-risk' jobs that use the ISCO-08 classification. The correspondence is not one US occupation to one ISCO-08 occupation, but rather one to many.

Some of the four-digit ISCO-08 occupations can be found only in specific sectors. Our data use the Eurostat statistical classification of economic activities in the European Community (NACE) classification for sectors. A list of ISCO-08 occupations in NACE sectors was developed under the European Union's Horizon 2020 Synergies for Europe's Research Infrastructures in the Social Sciences (SERISS) project[9] (Belloni and Tijdens, 2017), and, in a second step, using this list, we allocated some of the ISCO-08 occupations to NACE sectors, thus enabling a better identification of automatable jobs.

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[9]   https://seriss.eu/

As a result of this exercise, the list of occupations from Josten and Lordan (2019) was translated into the form of jobs (i.e. ISCO-08 occupations) found in NACE sectors. In a third step, we decided to reduce the level of occupations from four-digit to two-digit ISCO-08 occupations and two-digit NACE sectors. Following a similar method to Suta et al. (2018), we labelled a job (a two-digit ISCO-08 occupation in a two-digit NACE sector) as 'at risk' of automation if the number of detailed-level roles (four-digit level ISCO-08 occupations in NACE sectors) that could be automated was found to be higher than the number not suitable for automation.

Given the assumption underlying this decision and the uncertainty surrounding the adoption of the technology, we classified the jobs as 'at risk of automation' rather than 'fully automatable'. This reflects the fact that, while the technology exists to replace most tasks performed, the pace of automation will vary across countries and sectors. At the two-digit level, occupations have slightly different tasks depending on the sector and thus a different level of risk of automation. In Figure 5.1 we illustrate the findings based on this assumption, that is, we count the jobs profiles that are 'at risk' (fully automatable and polarised automatable) or 'safe' (non-automatable) in each broad occupational group. Since this represents simply a count of the number of job profiles, and does not take account of

the number of jobs with these profiles in a particular economy, no scale is shown in the figure, but the length of the bars helps to give a general indication of how automatable a particular occupation (at the one-digit level) might be. The jobs that still have no technological replacement are mostly managers, professionals and associate professionals. Clerks, plant and machine operators and assemblers as well as those in elementary occupations are the groups with the most job profiles for which technology is under development that could substitute for workers.

The manufacturing sector has many job profiles that are 'at risk', which is why so many of the occupations within the broad level of plant and machine operators and assemblers are deemed 'at risk'. Some parts of the service sector, such as transportation and storage, accommodation and food services, financial and insurance activities, real estate activities, and administrative and support service activities are also at risk, with a large proportion of their jobs in danger of automation. Some of these services are already heavily digitalised so this result is not unexpected. The least 'at-risk' jobs can be found in the information and communication, health and social care, and education sectors; for the last two in particular, this reflects the extent of social interaction required.

Figure 5.1. Number of job profiles 'at risk' of automation, by broad occupation
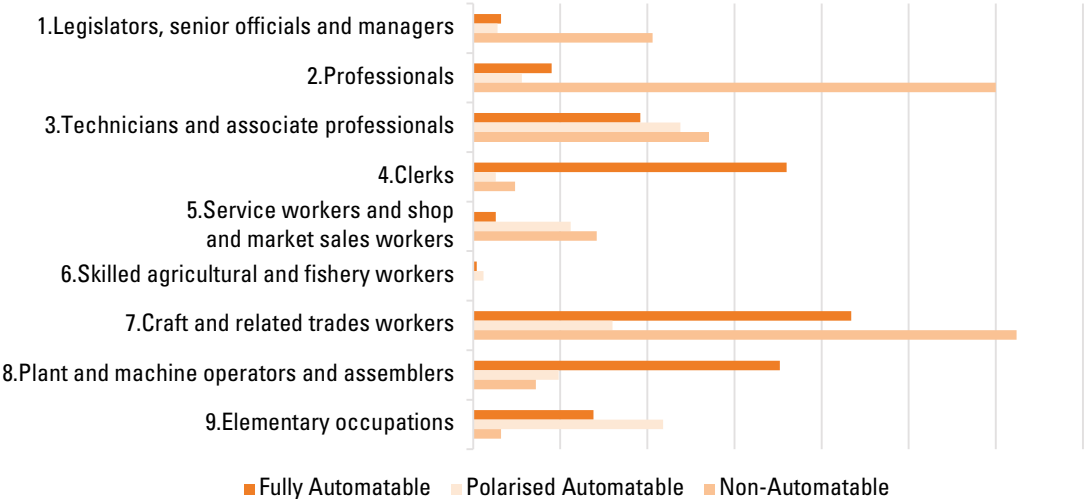
Note: The figure provides a comparison of the relative number of job profiles (particular occupations in certain sectors, at the two-digit ISCO and NACE level) that have been labelled as fully automatable, polarised automatable or non-automatable, within each broad occupation category. It does not take account of the number of jobs that have these profiles in a particular economy, but helps to give a general indication of how automatable a particular occupation might be.

Source: Authors' elaboration.

To move from four-digit to two-digit ISCO-08 occupations, we classified jobs (an occupation in a sector) as follows:

- 'safe' if the number of four-digit job profiles that are non-automatable within the two-digit occupation is higher than the number of four-digit job profiles that are either fully automatable or polarised automatable;
- 'at risk' if the number of four-digit job profiles that are non-automatable within the two-digit occupation is less than the number of four-digit job profiles that are either fully automatable or polarised automatable;
- 'balanced' if the number of four-digit job profiles that are non-automatable within the two-digit occupation equals the number of four-digit job profiles that are either fully automatable or polarised automatable.

By re-categorising the jobs from Josten and Lordan (2019) into 'safe', 'at risk' and 'balanced', we are not introducing new concepts. Rather, this step represents a simplification that allows us to aggregate the original jobs to a higher level and to interpret the existing and future trends related to these jobs in the two regions. This will give us an indication of the risk of automation in each country without the need to calculate a new indicator.

Before looking at the data by risk of automation, we start the analysis by looking at the structure of employment in Istanbul and North Macedonia.

In order to better prepare for the changes in future skills requirements, consideration needs to be given to the current educational level of those in employment – see Figure 5.2. In Istanbul, individuals with a low level of educational attainment still represent most of the employed population, and their share has tended to increase over time, contrary to conventional wisdom. On the other hand, the number of those with higher education has seen a rapid increase in the last five years. The proportion of those with a middling level of educational attainment, while on a rising trajectory, still represents a much smaller share of total employment than in North Macedonia or the EU.

In North Macedonia, the share of those with mid-level educational attainment increased over the period 2007–18, reflecting the needs of the economy. The proportion of individuals with higher educated meanwhile has increased at a slower pace, while the share of those with a lower education level has fallen. The rise in higher educational attainment is in line with the increased employment of professionals, while the expanding numbers of service and sales employees,

Figure 5.2. Employment by educational attainment level in North Macedonia and Istanbul (aged 15+), 2007–18

North Macedonia
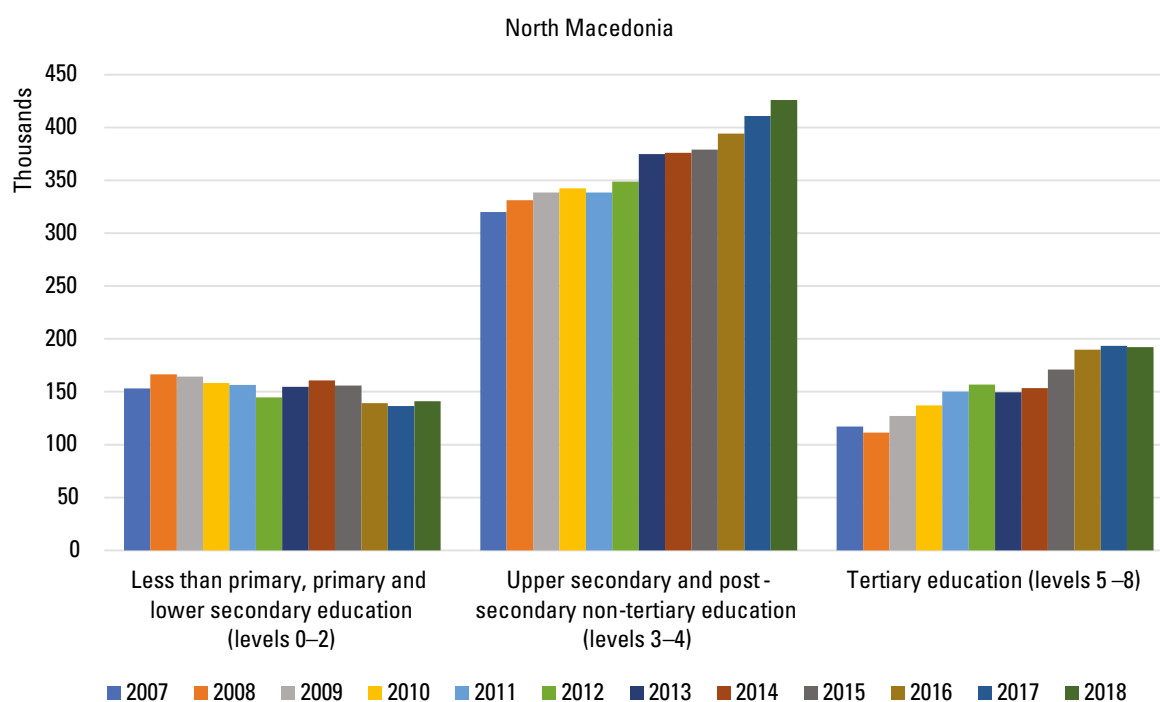
Figure 5.2. (Continued)

Istanbul
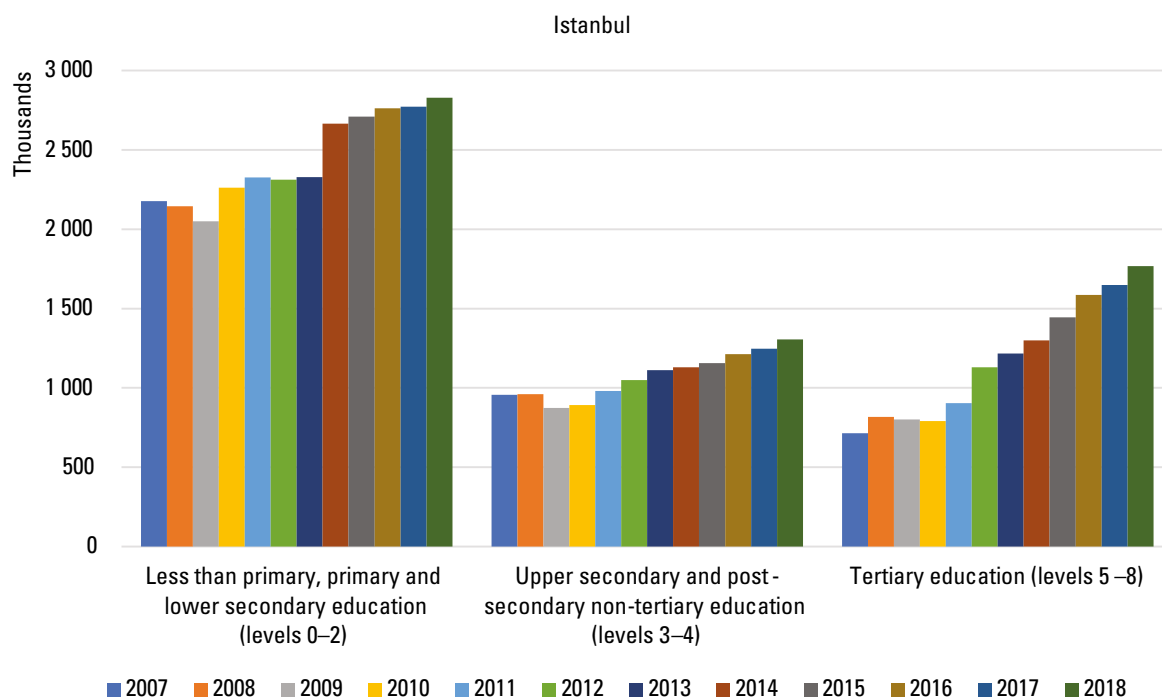
Source: Eurostat (2020b), last accessed 25 March 2020.

trade workers and operators and assemblers is consistent with the increase in workers with a mid-level education – see Figure 5.3[10]. Elementary occupations, while in decline, remain an important employment group in North Macedonia.

In Istanbul and North Macedonia, manufacturing and wholesale and retail trade, transport,

accommodation and food service activities are the main employment sectors – see Figure 5.4.

As discussed at the beginning of the previous section, in the case of Istanbul, data for employment by sector and occupation were estimated based on the share of employment by broad sector in Istanbul compared to Turkey

Figure 5.3. Employment by occupation in North Macedonia, 2008–18
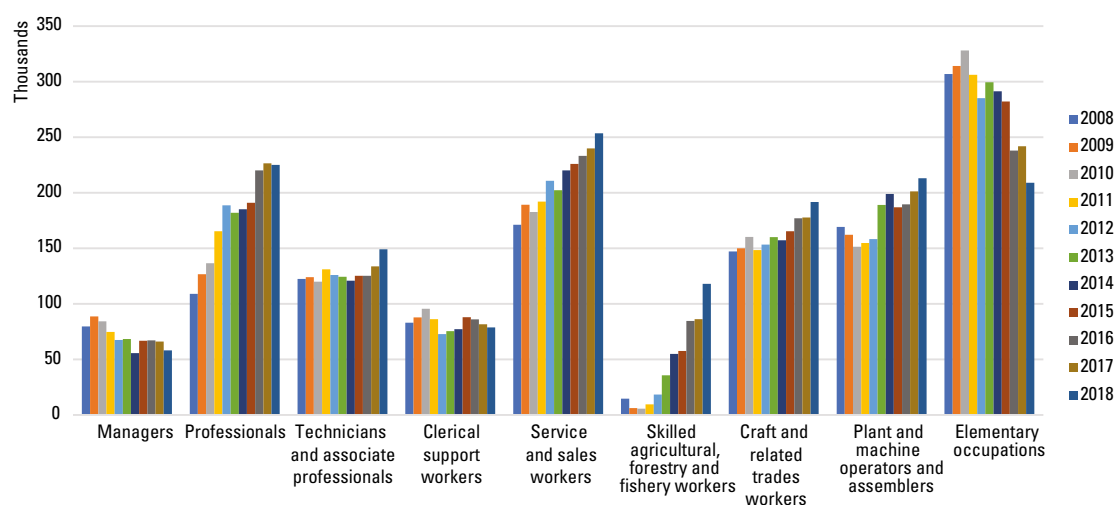
Source: Eurostat (2020c), last accessed 25 March 2020.

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10   There is no similar chart for Istanbul as the required Eurostat data is not available.

Figure 5.4. Employment by economic activity in North Macedonia and Istanbul (aged 15+)

North Macedonia

Istanbul
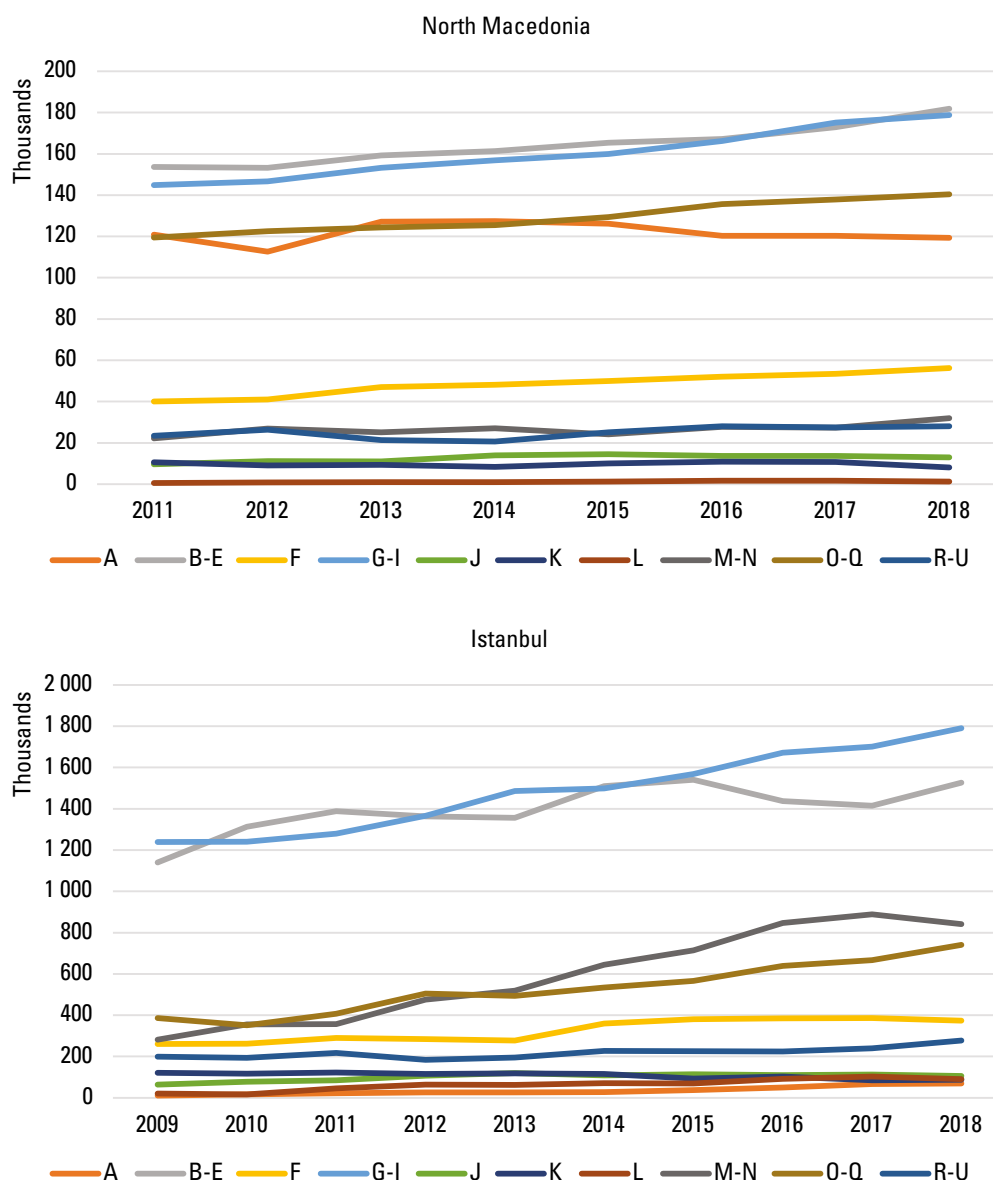
Notes: A – Agriculture, forestry and fishing; B-E – Industry (except construction); F – Construction; G-I – Wholesale and retail trade, transport, accommodation and food service activities; J – Information and communication; K – Financial and insurance activities; L – Real estate activities; M-N – Professional, scientific and technical activities, administrative and support service activities; O-Q – Public administration, defence, education, human health and social work activities; R-U – Arts, entertainment and recreation, other service activities; household activities and extra-territorial organisations and bodies.

Source: Eurostat (2020a), last accessed 25 March 2020.

as a whole, in order to enable carrying out the subsequent analysis based on the Cedefop 2018 Skills Forecast for Turkey (Cedefop, 2020).

Figure 5.5 shows the historical and expected evolution of total employment by job profile in Istanbul and North Macedonia. Overall, the job profiles 'at risk' are estimated to be on the rise in both regions. The 'safe' job profiles are also increasing but at a slower pace. Both regions appear to have more 'at-risk' job profiles than 'safe' ones.

The evolution over time in each of the regions might be driven by the sectoral or by the occupational structure (within sectors) of employment. Figure 5.1 has already shown that some occupations and sectors have more 'at-risk' job profiles than others.

To understand the evolution of future jobs, we look at occupations and sectors individually. Figure 5.6 shows future job prospects by occupation and by risk of automation. On the basis of past trends, the number of occupations with most of their

Figure 5.5. Evolution over time of total employment by automation risk in North Macedonia and Istanbul
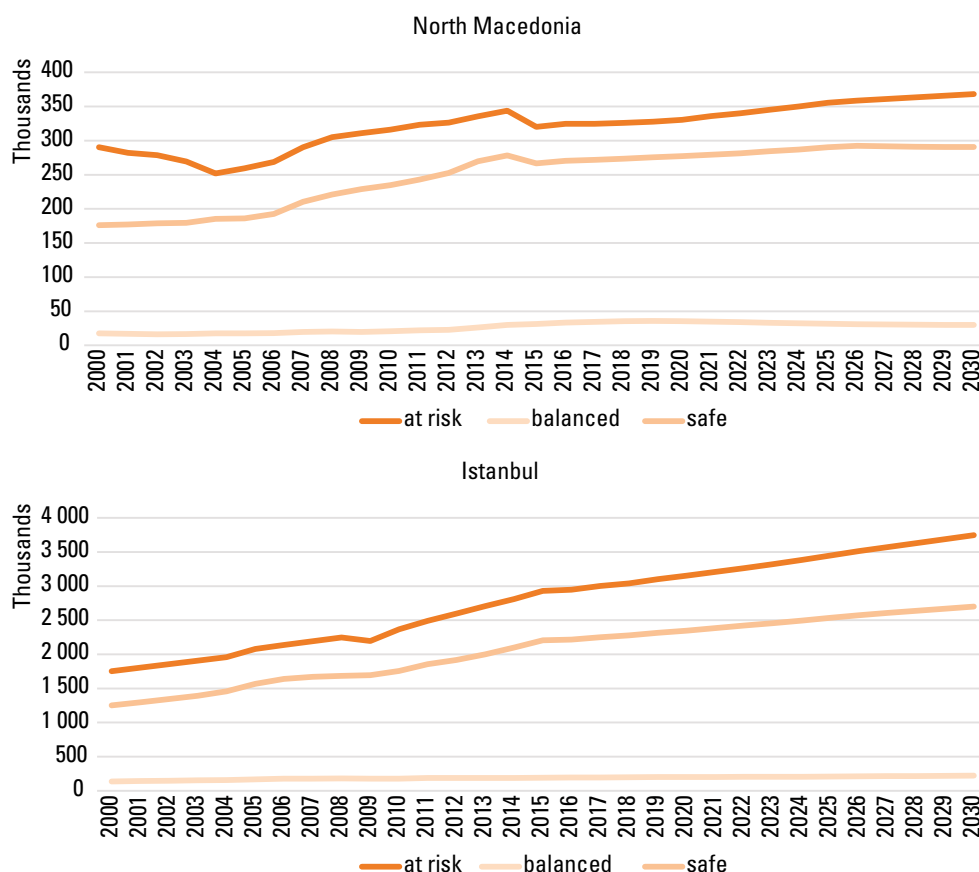
North Macedonia

Istanbul

Note: The data for Istanbul were obtained by applying Istanbul's share of employment in Turkey's total employment by sector for 2018.

Source: Authors' elaboration using the Cedefop 2018 Skills Forecast.

job profiles at risk of automation is expected to increase over the period 2018–30. Currently in North Macedonia service and sales staff, operators and assemblers and workers in elementary occupations are important occupations (see Figure 5.3), and they are expected to continue to expand in the future in both Istanbul and North Macedonia. Furthermore, professionals and associate professionals seem to have good prospects in terms of job profiles which are either 'safe' or 'balanced', and in North Macedonia, these two broad occupations represent a high share of current employment. For the few professionals who are 'at risk', the transition matrix that is used in this study, and can be found online, shows the safer job profiles that they could transition to (see Section 5.3.2 Regional analysis of occupational transitions (the 'transition matrix' approach) below), while Figure 5.6 demonstrates that there is likely to be demand (i.e. it is projected to be a relatively strong demand for professionals in both regions, as almost all of these profiles are classified as 'safe'). The same cannot be said for the other occupations.

In the case of service and sales workers, the transition matrix also highlights a number of 'safe' job profiles that they could transition to with comparatively little effort, some within the same broad occupation. In the case of Istanbul and North Macedonia, the 'balanced' jobs are expected to shrink while the 'safe' ones are expected to expand (much more so in Istanbul than in North Macedonia, probably due to the sectoral structure of the two economies). While 'at-risk' workers in North Macedonia may still be able to move to another occupation with good job prospects, such as associate professionals, more effort (in terms of training and education) will be required for such a transition.

The importance of particular occupations and future job prospects in general are driven by the sectoral structure of the economies in North Macedonia and Istanbul – see Figure 5.7. In Istanbul the broad sector 'professional, scientific and technical activities, administrative and support service activities' is expected to experience the biggest

Figure 5.6. Employment change (absolute numbers) by occupation and risk of automation, 2018–30

North Macedonia

1. Legislators, senior officials and managers
2. Professionals
3. Technicians and associate professionals
4. Clerks
5. Service workers and shop and market sales workers
6. Skilled agricultural and fishery workers
7. Craft and related trades workers
8. Plant and machine operators and assemblers
9. Elementary occupations

■ At risk ■ Balanced ■ Safe

Istanbul

1. Legislators, senior officials and managers
2. Professionals
3. Technicians and associate professionals
4. Clerks
5. Service workers and shop and market sales workers
6. Skilled agricultural and fishery workers
7. Craft and related trades workers
8. Plant and machine operators and assemblers
9. Elementary occupations

■ At risk ■ Balanced ■ Safe

Note: The data for Istanbul were obtained by applying Istanbul's share of employment in Turkey's total employment by sector for 2018.

Source: Authors' elaboration using the Cedefop 2018 Skills Forecast.

increase, driven by its expansion in Turkey as a whole. However, a majority of the job profiles in this broad sector are at risk of automation, so it is quite possible that by 2030 the increase in employment in these jobs will be much lower than forecast or will even shrink. In North Macedonia industry (except construction) is an important sector, but it includes many job profiles that are 'at risk'. For

some of these 'at-risk' profiles there are no 'safe' occupations into which workers can transition easily. The job profiles 'at risk' within the wholesale and retail trade, transport, accommodation and food service sectors are in a similar situation. The projected future increase in employment in these areas is based on the growing demand for services in the economy.

The transition matrix can also be used to identify 'safe' job profiles in different sectors that have better future prospects (as indicated in Figure 5.7).

The above figures are the result of a modelling and data construction exercise based on several assumptions, but even with these caveats they have significant added value for policy makers in the two regions. While some uncertainty remains over the exact number of job profiles at risk of automation, it is clear that many jobs in manufacturing and services are under threat from new technologies. Many of the job profiles which are at risk are found in occupations that are traditionally low and middle skilled.

For the next step of the analysis we focus on a number of relevant jobs (occupations in a sector) in Istanbul and North Macedonia based on the

analysis above. The choice of examples for North Macedonia was driven by the sectors which had an employment share of more than 15% in 2018 – that is, the larger sectors in Figure 5.7. In the case of Istanbul, we chose the sectors based on the employment there in 2018, but also highlighting those that are important for Turkey as a whole. The entire list of occupations and sectors is available online (Tableau, 2020).

5.3.2 Regional analysis of occupational transitions (the 'transition matrix' approach)

This section shows how the methodology described in Section 5.2.2 is used to identify the possible occupations and sectors (i.e. jobs) into which workers in 'at-risk' jobs could potentially transition. We describe this in the form of a transition matrix and focus in particular on an occupational group that

Figure 5.7. Employment change (absolute numbers) by broad sector, 2018–30
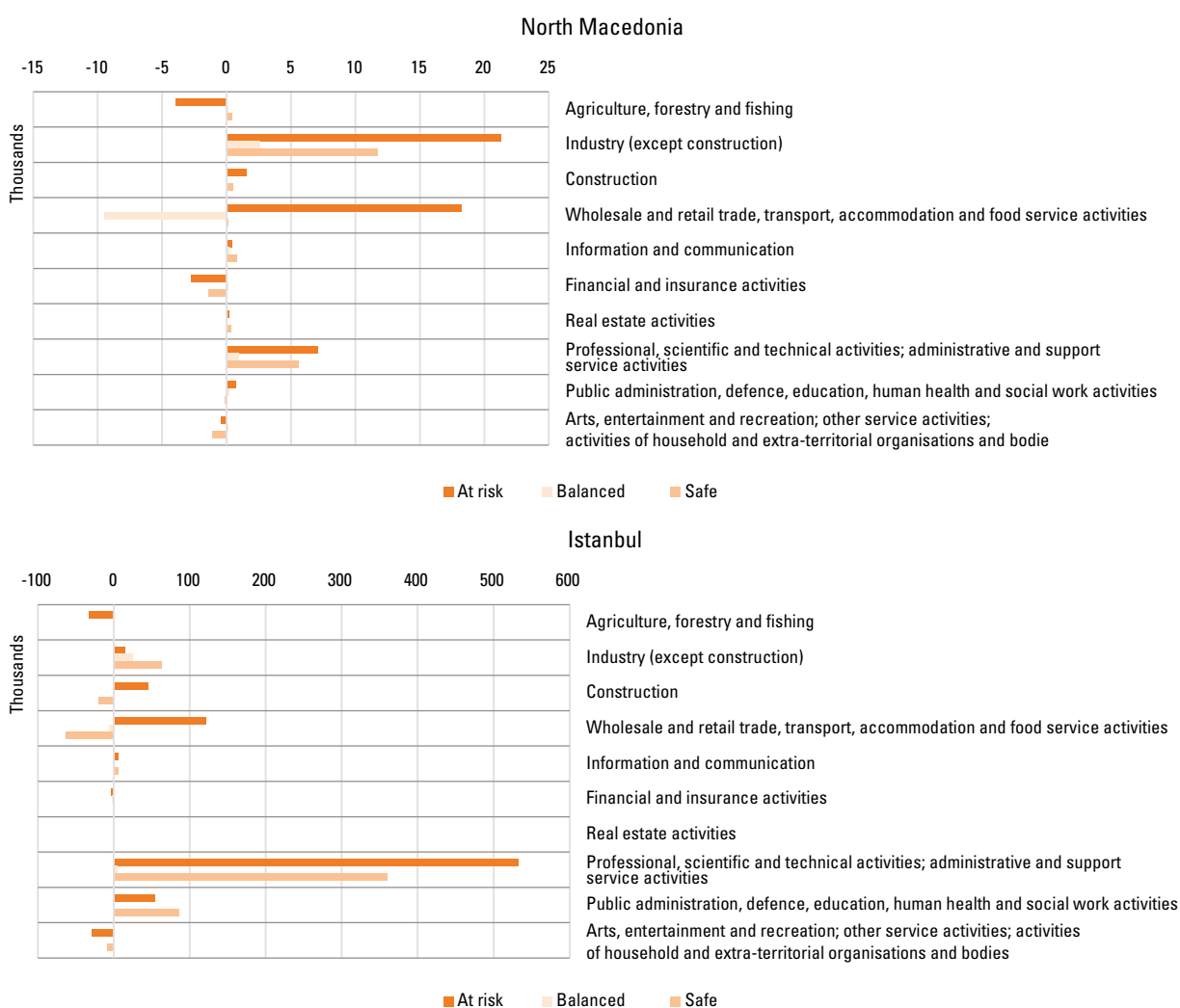
Note: The data for Istanbul were obtained by applying Istanbul's share of employment in Turkey's total employment by sector for 2018.

Source: Authors' elaboration using the Cedefop 2018 Skills Forecast.

is relevant to both Istanbul and North Macedonia: machinery maintenance occupations.

To build the occupation transition matrix, we start with O*NET's Career Changers Matrix. For each O*NET occupation, the matrix provides up to 10 related O*NET occupations that have been assessed by O*NET researchers as utilising similar skills and experience (National Centre for O*NET Development, 2012). At this stage of the analysis, the careers are not specific to any particular sector.

Next, we link the occupations to the one-digit NACE sectors that are relevant to each region. The result is a matrix that shows, for each 'at-risk' occupation, a list of non-automatable jobs that a person could potentially change to with a minimal or small amount of effort, within the industry sectors that are important to the two regions. This is illustrated for machinery maintenance occupations in Figure 5.8.

Figure 5.8 shows, as rows, the 'source' occupation, 'machinery maintenance occupations' and the corresponding NACE sectors 'B Mining and Quarrying' and 'C Manufacturing' in which it can be found. According to the Josten and Lordan (2019) classification, this group of occupations is fully automatable. What this table suggests is that, for each of the automatable source occupations, there are several potential target occupations that could provide alternative employment. We would need

to add further refinement to this career change matrix in terms of employment growth (stability) and income comparability in the target occupations identified here, to help determine whether they would in fact be worth retraining for.

The columns show the 'target' occupations that were identified as being either non-automatable or polarised automatable. These are occupation groups into which people in machinery maintenance occupations could potentially transfer with relatively little additional preparation in terms of developing skills and knowledge.

The legend shows the region (North Macedonia and Istanbul) to which each combination of occupation group and sector is important, according to the regional analysis described previously. Thus, we can see that people in machinery maintenance occupations in both Istanbul and North Macedonia could potentially transition to the bus, truck and stationary engine mechanics occupational group in the manufacturing sector in both regions. However, the same target occupational group in the 'G Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles' sector only appears to be important in Istanbul.

Unsurprisingly, the target list of possible jobs in Figure 5.8 is quite short, as most occupations in these groups are classified as fully automatable.

Figure 5.8. Career change matrix for machinery maintenance occupations

Source: Authors' elaboration.

The entire matrix of possible career changes for the relevant jobs in Istanbul and North Macedonia is available online (Tableau, 2020).

5.3.3 Skills, work content and associated risks to automation – an example for North Macedonia

The transition matrix approach described in the previous section allows us to take a first look at potential targets for career movers whose current occupation is at risk of automation, using the Career Changers Matrix available in the O*NET database. However, this approach does not give a sense of how much upskilling may be required or what forms this might take. The next part of our analysis looks at the specific skills and work content that influence whether an occupation is at risk of automation.

Using the complementarity approach described in Section 5.2.2, we identified the following elements from the O*NET database that influence the potential of occupations to be automated:

- Automation 'at risk' elements:
  - data collection,
  - data processing,
  - repetitiveness,
  - degree of automation.
- Automation 'safe' elements:
  - complex problem solving,
  - creativity,
  - critical thinking,
  - social elements (e.g. negotiation,
  - unpredictable physical activity (e.g. troubleshooting).

Figure 5.9 Comparison of automatable/non-automatable element importance for metal platers in North Macedonia

	Polarised Automatable Occupations		
	Low Preparation Occupations		Medium Preparation Occupations
	Forge and hammer operators	Machine feeders and off-bearers	Welders and metal cutters
Complex Problem Solving	3.3	25	0
Creativity	-4	30.5	-11.5
Critical Thinking	3	12.5	-3
Data Collection	-3.5	3	4
Data Processing	-1.8	9	-8
ICT Programming	-6.3	0	-6.3
Degree of Automation	-34	-33.5	53.8
Repetitiveness	-1.8	-5.3	0.8
Social	3	37.5	22
Unpredictable Physical	-16	-31.3	-110.3

Legend:
- Target occupation is LESS at risk of automation
- Target occupation is MORE at risk of automation

Source: Authors' elaboration calculated using O*NET data.

To illustrate this approach, we consider metal platers in the manufacturing sector in North Macedonia as the source occupation. This is a fully automatable occupation, which, according to the transition matrix approach described in the previous section, has three polarised automatable target occupations – all in the manufacturing sector – which are also relevant to the region: (1) forge and hammer operators; (2) machine feeders and off-bearers; and (3) welders and metal cutters.

The entire matrix of possible automation comparisons for relevant jobs is available online (Tableau, 2020). A qualitative interpretation of the analysis for metal platers is shown in Figure 5.9.

To investigate the closeness of the source and target occupations in automation terms, we aggregate and then take the difference of the O*NET standardised importance scores (hereafter 'scores') for automation elements between the source and target occupations. The aggregate differences in the scores are shown in Figure 5.9: a positive number indicates that the source occupation (in this case metal platers) places higher importance on an element than the target occupation, and vice versa for a negative number.

It is also important to note that for some elements (e.g. complex problem solving) a higher aggregate score for a target occupation indicates that in this respect it is *less* automatable than the source occupation, while for others (e.g. data collection and data processing) a higher score for a target occupation means that in this context it is *more* automatable than the source occupation. As a guide, the significant elements in terms of the aggregate differences are highlighted in light orange (target occupation is less at risk of automation) and dark orange (target occupation is more at risk of automation).

The overall comparison between pairs of occupations is currently a qualitative judgement, based on a consideration of all the elements. However, as follow-on work we envisage that a weighted index could be developed.

Given the explanation in the previous paragraphs, we can make the following statements regarding the comparison between metal platers and the target occupations:

- Machine feeders and off-bearers require lower complex problem solving ('safe') skills than metal platers. However, all occupations – source and targets – score low in overall terms, so this is not likely to be a significant set of elements to consider.

- A similar conclusion may be drawn for creativity and critical thinking ('safe') skills, although welders and metal cutters do score relatively highly in creativity, indicating that the target occupation may be less automatable in that context.
- Data collection, data processing and ICT programming skills are insignificant across all occupations.
- Welders and metal cutters have significantly lower degree of automation ('at risk') scores, indicating that they are relatively 'safe' occupations compared to both the source occupation and the other target occupations.
- While repetitiveness is a strong 'at-risk' element, all occupations score about the same, and so the indicator cannot be used to draw comparisons. However, all occupations do score relatively highly in absolute terms, indicating that some parts of all the occupation could be automatable. In the case of the target occupations, this may be a contributory factor in their being classified as 'polarised automatable'.
- No real significance can be attached to social ('safe') skills in both source and target occupations, as the absolute importance scores (not shown in the figure) are low for all of these occupations.
- While the above factors are relatively inconclusive, some degree of significance may be attached to the unpredictable physical ('safe') elements. In particular, welders and metal cutters appear to work in more unpredictable physical environments, with some sub-elements such as arm-hand steadiness and multi-limb coordination (not shown in the figure) scoring highly in both relative and absolute terms.

The final points to consider in this analysis are the relative levels of preparation of the source and target occupations. Using the O*NET job zone approach described in Section 5.2.2, we see that two of the target occupations – forge and hammer operators, and machine feeders and off-bearers – are low preparation occupations, typically requiring little in the way of education, related experience and on-the-job training. Since the source occupation itself is also rated as low preparation, we may infer that the transition 'cost' between the source occupation and these two target occupations is relatively small.

The occupations of welders and metal cutters, on the other hand, are rated as medium preparation, indicating that some degree of cost – both in terms of time and money – may be incurred during the upskilling process. How much this cost may be, the data do not tell us. However, here we can offer some insight from the authors' experience and

suggest that a metal plater may consider a staged move to a new career in welding. Becoming a fully certified and coded welder can take between 18 and 36 months, but during that time welding skills and knowledge can be developed which enable some welding tasks to be undertaken. Over a four-week period it is possible to train someone with prior work experience of handling metal and metal sheets to undertake basic welding. Then, over a six to eight month period, it is possible to move from basic welding to cover visual weld inspection and the fundamentals of welding before tackling intermediate and advanced welding skills (STICK, TIG and MIG welding).

We suggest that a good general approach for managing the move from an 'at-risk' occupation to a 'safe' occupation which is relatively close in general competence terms but which requires additional preparation, could be managed through a series of relatively short courses that build a set of micro-credentials enabling entry to the new occupation.

5.3.4 Occupations with a limited opportunity for 'low-cost' career change – an example for Istanbul

While we have found that, through a combination of data and occupational analysis, we can identify viable 'low-cost' career moves for many occupations which are 'at risk' of automation, this is not true for all such occupations in the regions under study. In these cases, while the transition matrix approach, combined with an analysis of skills, work content and job preparation levels, may identify target occupations at similar or lower levels of preparation, it is still not possible to identify meaningful upskilling paths to other occupations that are relevant to the region in question. An example is given in Figure 5.10.

In this example, which features a relevant job for Istanbul, the occupational group 'cooks, variously defined' (a low-preparation occupation which includes short-order cooks and preparers of fast-food, but not more highly qualified chefs de cuisine, pastry chefs, sauciers and sous-chefs) is identified

Figure 5.10. Comparison of automatable/non-automatable element importance for cooks in Istanbul

	Non-Automatable Occupations	Polarised Automatable Occupations	
	Low Preparation Occupations	Little or No Preparation Occupations	Low Preparation Occupations
	Managers of food-serving and lodging establishments	Kitchen workers	Bartenders
Complex Problem Solving	-3.3	31	9
Creativity	9	6.5	-11.8
Critical Thinking	-9.3	12.5	3.3
Data Collection	-5	19.5	-4
Data Processing	5	11	4.5
Degree of Automation	8.5	-4.5	34.5
ICT Programming	-3	9.5	3.3
Repetitiveness	-8	-8.8	1.5
Social	0.8	72.3	28.5
Unpredictable Physical	22	34.3	-30.5

Legend:
- Target occupation is LESS at risk of automation
- Target occupation is MORE at risk of automation

Source: Authors' elaboration calculated using O*NET data.

as having potential transition paths only to other low-preparation occupations. While a full transition matrix may well identify upskilling paths – for example to the higher-trained chef levels – the regional analysis described in Section 5.3.1 does not identify these occupational groups as being relevant to the region because the numbers employed in these occupations are small.

5.4 Conclusions and comparison with similar research

There are many studies that assess the risk of automation in different countries or regions (Frey and Osborne, 2017; Josten and Lordan, 2019; Nedelkoska and Quintini, 2018; Pouliakas, 2018). This article extends that analysis to consider transition possibilities. We use the list of automatable jobs from Josten and Lordan (2019) together with an experimental methodology to analyse the job profiles that are 'at risk' and identify possible transitions to 'safer' roles, while also taking into account the future prospects of these occupations. The analysis suggests a way to construct reliable estimates with limited information, both at the sectoral and occupational level.

For the two regions, Istanbul and North Macedonia, we obtain a picture of the distribution of 'at-risk' job profiles by occupation that is similar to that of Suta et al. (2018) for the EU-28, and McKinsey (2020) for EU-27 countries plus the United Kingdom and Switzerland. It is mostly low- and medium-skilled workers who are 'at risk', although some high-skilled job profiles are also vulnerable based on the current tasks that are performed in the job. Sumer (2018) classifies jobs in Turkey based on routine, manual and cognitive tasks. The findings for one-digit occupations are similar to those illustrated in Figure 5.6: the categories of technicians and associate professionals, clerks, service workers and shop and market sales workers, and plant and machine operators and assemblers might be adversely affected by new technologies and thus susceptible to replacement.

Sections 5.3.3 and 5.3.4 illustrate the profiling and comparisons that can be generated between occupations at risk of automation and target jobs that are not in danger. This provides evidence to help develop pathway opportunities for displaced and impacted workers. Our analysis focuses only on the movement of employees from 'at-risk' occupations to comparable and closely related occupations, where the transition costs are likely to be lower than those incurred in attaining new and emerging (usually higher-level) jobs. The desirability of these transitions needs to be considered from

the perspectives of at least three stakeholders: the individual, the employee, and government, as they all have different costs to bear in funding such pathways.

A study by the World Economic Forum and Boston Consulting Group (2019) established that reskilling a displaced worker would, on average, cost USD 24 800 and take up to two years. The report also examined the potential for reskilling employees to enter new and emerging jobs. For example, in the aerospace sector, a field which might face the fastest pace of automation, three new and emerging occupations were identified: data analyst (general), automation technician and industrial engineer, all of which can be filled from current, internal job holders.

Our analysis shows that policy makers in both regions (as elsewhere) need to start preparing their workforce to transition to other occupations or sectors. In some cases, this will require little effort, but in other cases ensuring workers' mobility is likely to require the provision of substantial training. Policy makers should also consider the future sectoral structure of the economy, as the new technologies might affect more services and some manufacturing activities than others. In all cases, employment in the sector or occupation will not entirely disappear, but it will shrink to the extent that it causes structural unemployment in the short term. Plans for lifelong learning must start early as there are not enough 'safe' job profiles to which those 'at risk' can transition easily.

Our approach has added to the process of mapping and exploring the impact of AI/automation on work content. The objective of occupation 'at risk profiling' is to refine the comparison between origin ('at risk') and potential target occupations ('safe'). The approach employed here builds on the contributions of others (Cedefop, 2014; Eggenberger et al., 2018; Lazear, 2009; WEF and BCG, 2019) and needs to be developed further to fully recognise the broader abilities of employees (rather than simply inferring these from the positions they currently hold) and to translate the distance between occupations (OECD, 2018b; Robinson, 2018) into an assessment of the time and costs necessary for reskilling workers to entry into similar occupations. We have found no studies which have tackled the translation of the distance between occupations into a usable measure to allow governments to estimate the need for, and devote appropriate resources to, reskilling.

There are important differences between at least one of our selected 'regions', Istanbul, and many western countries with regard to the number

of people willing to retrain and learn new skills: according to one study, 76% of people in Turkey expressed a willingness to reskill versus 53% in Germany (BCG, 2019). The same analysis also found that in Turkey 78% of people have undertaken at least a few weeks' training compared to 42% in France, and it went on to include Turkey in a 'proactive adaptor' group of countries as regards its approach to reskilling (at the individual level).

Further refinements to the approach adopted here are possible and require further exploration so that we can more fully understand how various occupations and their holders can successfully

transition to 'safer' employment in a period of relatively rapid change.

This work should be seen as the first step in a series of analyses with the aim of helping workers in 'at-risk' jobs develop resilience in the face of technological change. The next stage of the research will be to increase the level of detailed task analysis and examine the automatable tasks more closely. Another area of development will be analysing educational profiles and developing a proxy measure of the distance between job profiles that can be translated into a way of calculating the cost of making the transition between two occupations.

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ICT SERVICES EXPORTS AND LABOUR DEMAND: A GLOBAL PERSPECTIVE AND THE CASE OF ISRAEL

Eyal Ronen

In recent decades, economic growth around the world has mostly been driven by technological acceleration, along with growing consumer demand for information and communications technology (ICT) products and services. These developments have pushed ICT services exports to the forefront of the global trading system. However, overall employment in the ICT sector has not shown a similar expansion. This asymmetry could be partially explained by different employment trends prevailing in each ICT sub-sector, due to a shift in specialisation from manufacturing-intensive exports towards services-oriented exports. A particularly interesting country to examine in this regard is Israel, which has demonstrated outstanding performance in ICT services exports since the early 1990s, accompanied by a surge in demand for high-skilled employees. This article aims to identify the main determinants of labour demand in the ICT service sector across different country income groups and genders. The empirical cross-country panel analysis validates the positive contribution of ICT services exports to employment in the ICT service sector, particularly in high-income countries and among female employees. The article further highlights the considerable role of public policies in boosting labour demand in the ICT services sector, predominantly through funding for ICT research and development and tertiary education.

6.1 Introduction

Recently the services sector has experienced a significant expansion in its global markets. This sector has always been a pivotal contributor to international output and employment, but given the non-tradable character of many services activities, it barely exceeded a quarter of the world's trade flows. Only in recent years have signs of change emerged, as the globalisation of services has become a major driving force in world economic growth. Demand for technological solutions along with digital-based services has expanded rapidly, and the global trading system has aligned itself accordingly. A notable development in this regard has been the continuous shift away from manufacturing-intensive to service-based exports, which implies the existence of a substitution effect. Services exports have grown faster than manufactured exports, with their share of the global market tripling since the early 2000s when it was estimated at 7%. This pattern is particularly noticeable in developing countries, where the annual growth of services exports was double the 5% rate of developed economies in 2018, thus increasing their share in world services exports to 30% (UNCTAD, 2019).

Among exported services, a prominent sector is information and communications technology (ICT), which is enjoying a remarkable growth, both in magnitude and in its relative share of total trade. The ICT revolution has brought about huge transformations, not only in where things are produced, but also on firms' decisions regarding how to disaggregate their global value chains and outsource non-core services. Moreover, ICT is the category in which services trade has expanded most rapidly in recent years, recording an annual growth of 14.7% in 2018, double the rate of transport, travel, insurance, finance, intellectual property and other business services (UNCTAD, 2019). Compared to different services sectors, it is forecast that up to 2040, the highest growth in trade will be in ICT services (WTO, 2019). ICT services account for nearly 80% of world ICT demand, of which telecommunications and IT services are the most substantial segments. Content and especially internet services lag behind these areas, yet they too have grown substantially in the last decade.

The increasing demand for ICT products and services has led countries to develop various supportive policies to gain a greater competitive advantage. To that end, countries are making efforts to support affordable broadband internet connectivity and ensure the availability of online services, as well as stimulating research and development (R&D) investments and lowering trade costs associated with the consumption of technological products. One critical factor has been the adoption of the Information Technology Agreement (ITA)[1] in 1996 to eliminate import tariffs and other trade barriers on all IT products, which introduced a powerful impetus for countries to specialise in ICT hardware production. Hence, the growth in ICT goods exports, particularly in Asian countries, represents a move in the opposite direction from that implied by the substitution effect mentioned above. Nonetheless, these two trends may occur simultaneously, and even complement each other through two main channels. The first channel is the growing role of services as inputs in manufacturing production, or the 'servicification of manufacturing'[2]. The second channel relates to pre-sale and product support (post-sale customer service) provided for a range of ICT product exports.

These trends affect employment opportunities in the ICT sector, and influence labour demand in each ICT sub-sector based on their distinctive features, such as labour intensity, level of productivity per employee, or participation rate by gender, age and skills. A question is raised concerning the extent to which these two opposite forces generate structural changes in ICT employment. Given the varying degrees of government support for ICT sector development in different countries, it is interesting

to explore the results of a range of recent policy initiatives (e.g. government spending on R&D and higher education, investment freedom).

This article introduces an empirical framework to analyse these relations by building cross-country panel data to explore the impact of ICT services exports on labour demand, taking into account the regional and income-group variations. The case of Israel is explored in more detail, as its remarkable performance in ICT services exports has been accompanied by a significant rise in employment – 700% since the 1990s. Israel also serves as a unique example of how extensive public support (direct and indirect funding) has turned a small country into a global leader in ICT services in less than three decades. Combining an analysis of general world trends (across regions and country income groups) with the specific case of Israel, this study provides empirical evidence to show how ICT services exports contribute to achieving higher levels of employment.

The remainder of the article proceeds as follows. The next section provides a review of the relevant economic literature. Section 6.3 describes the global trends in the ICT sector and its workforce patterns, as well as the specific characteristics of the Israeli ICT market. Section 6.4 presents the methodology used to identify the main determinants of labour demand in the ICT services sector and the contribution of different factors to employment in this area across country groups and gender. In this section, ICT employment trends in Israel are analysed and compared with those of the EU-27. The last section presents the conclusions and discusses the possible policy implications of the empirical findings as well as avenues for future research.

6.2 Literature review

This article contributes to several strands of the theoretical and empirical literature on the correlations between the proliferation of ICTs and various macroeconomic indicators, including labour markets. First, it builds on a considerable body of work on services trade, and particularly on ICT and potentially ICT-enabled services trade. These studies provide insights regarding current trends and advancements in the global digitalised services trade in recent years. This research field includes works by, among others, Van Welsum and Reif (2009), Caron et al. (2014), Grimm (2016), Nicholson (2016), Ciriani and Perin (2017), Liu and Nath (2017), Fefer (2017), and WTO (2019).

Secondly, this article contributes to the research highlighting the beneficial relations between ICT

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[1]   ITA was concluded by 29 countries at the Singapore Ministerial Conference in December 1996. Since then, the number of participants has grown to 82, representing about 97% of the world trade in IT products. It aims at completely eliminating tariffs on IT products covered by the Agreement, including computers, telecommunication equipment, semiconductors, semiconductor manufacturing and testing equipment, software and scientific instruments, as well as most of the parts and accessories of these products. In 2015, nearly all members agreed to expand the list of products covered by the ITA by an additional 201 products, valued at over USD 1.3 trillion per year and accounting for approximately 7% of total global trade. The new accord covers the new generation of semiconductors and semiconductor manufacturing equipment, optical lenses, GPS navigation equipment and medical equipment. For more information, see: www.wto.org/English/tratop_e/inftec_e/inftec_e.htm

[2]   Services value added accounts for almost a third of manufacturing exports in developed countries and 26% in developing economies (Lanz and Maurer, 2015). For more on the role of services in traded manufactured goods, see Miroudot and Cadestin (2017), and Heuser and Mattoo (2017).

adoption and economic performance. Notably, numerous studies have focused on the impact of advances in ICT usage on fundamental issues such as output growth, competitiveness and productivity (e.g. Schreyer, 2000; Holt and Jamison, 2009; Czernich et al., 2011; Cardona et al., 2013; Biagi, 2013; Bertschek et al., 2015; Jorgenson and Vu, 2016; De Stefano et al., 2018; and Atkinson, 2018). Attention has also been devoted to the role that ICT deployment plays in corporations' internationalisation decisions, along with its direct and indirect impact on export competitiveness (e.g. Portugal-Perez and Wilson, 2012; Ricci and Trionfetti, 2012; Kuivalainen et al., 2013; and Hagsten and Kotnik, 2017). These studies often validate the positive effects of the proliferation of digital products and services on firms' economic performance, which leads, in turn, to broader economic benefits. Other studies have analysed the impact of investment in this field (Guerrieri et al., 2011; Aboal and Tacsir, 2018), particularly the role of public R&D expenditure in ICT development (Stančík and Rohman, 2014; Pieri et al., 2018).

Thirdly, this article builds on studies of the labour market effects of ICT diffusion (e.g. employment levels, wages, labour productivity). Related publications include works by Doms et al. (2004), Van Ark et al. (2008), Gonzales et al. (2012), Cette et al. (2013), Akerman et al. (2015), Chen et al. (2016), and Relich (2017). Contrary to the perception that ICT advancements may pose massive challenges to low-skilled labour due to its potential for substitutability, studies generally validate the opposite effect. They show that ICTs have positive effects on job markets, irrespective of factors such as economic development and worker qualifications. Moreover, although the ICT sector represents a relatively small share of the total economy, and ICT jobs tend to require higher skills and education, the potential for ICT to lead to job creation is higher relative to other sectors. Notably, in the United States, each new ICT job resulted in almost five additional jobs in other industries (Moretti and Thulin, 2013). Further aspects related to gender inequalities and social inclusion in the presence of a fast-growing ICT environment are discussed in Williams et al. (2019).

While most studies focus on the adoption and diffusion of ICT services through digital channels, which can easily be related to all economic sectors, this article addresses the traded output generated within the ICT sector. The findings have particular importance because, although ICT services are increasingly traded, evidence capturing their actual effects on employment is lacking. This article contributes to the literature review above by providing an econometric framework which analyses various

channels (i.e., high levels of education, specialisation skills, wages, public investment in R&D) that could potentially explain current employment trends in the ICT services sector. In particular, it focuses on how ICT services exports impact labour demand between genders and across countries.

6.3 ICT services exports and employment

6.3.1 Global trends

Over the past two decades, the world economy has experienced a structural transformation from manufacturing-intensive exports to services-based exports. Compared to the mild growth in goods exports, services exports have rapidly expanded, at an annual rate of 7.5%, reaching 23% of total worldwide trade, estimated at USD 6 trillion, in 2019. The main beneficiaries have been developing countries, which captured a 30% share of global services exports in 2019 (UNCTAD, 2019)[3]. In particular, ICT services exports, which make up a sizeable percentage of total services exports, further amplify this trend. In terms of the annual average percentage, the share of ICT services in overall services exports has risen from 22.9% during the early 1990s to 32.4% in 2018. Despite the dominance of high-income countries in the total ICT services exports (71.5%, as shown in Figure 6.1), it is evident that ICT services exports

Figure 6.1. ICT services exports by country income groups, 2019 (BoP, current USD)
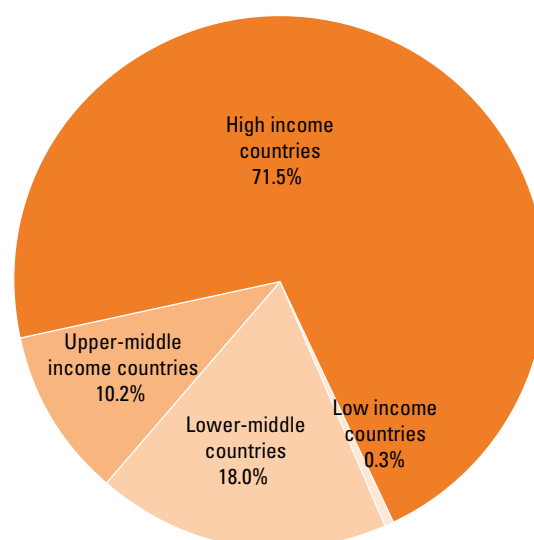
Source: Author's calculation using data from the UNCTADstat database.

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[3] Unless stated otherwise, all the figures presented in this section were calculated by the author, using data extracted from the multiple sources listed in the Annexes.

vary considerably across country income groups (cf. 10.2% in upper-middle income countries and 18% in lower-middle income countries).

The most significant acceleration has occurred in upper-middle income countries, followed by the lower-middle income group (Figure 6.2), with certain countries more successful than others. Annex 6.1 presents the top 10 exporters of ICT services in 2018 based on several variables. From the first to tenth they are: Ireland, India, the USA, Germany, China, the UK, Israel, France, the Netherlands and Sweden. In 2018, among ICT services exports, the leading sub-sector was computer services (81%) while telecommunications and information services represented the remaining 19% (WTO, 2020). Six out of the top ten ICT service exporters are from the EU, but the list also includes Israel, India, the US and China. If we take India, for example, its ICT service exports constitute almost 17% of the global exports in this sector, and 66% of its own total service exports. As of 2018, India had 4.4 million employees working in ICT services.

Among the high-income countries, the accelerated de-industrialisation process moving the countries' outputs towards ICT-related services is particularly noticeable in the European Union (EU). While

ICT goods exports have recorded an overall 1% annual growth since 1995, the EU ICT services exports grew by 15%, with Ireland, Germany, the UK, France and the Netherlands at the forefront of the trend, corresponding to two-thirds of the EU ICT services exports. As Figure 6.3 shows, this trend is also seen in the falling share of ICT goods exports in the EU-27: from 10.7% in 2000 to 5.2% in 2018. Conversely, the share of ICT services as a percentage of total services exports grew from 27.7% to 37.5% in the same period.

Despite the importance of manufactured ICT products, it seems that in terms of exports they follow the same trajectory as global merchandise. The share of global ICT goods exports (% of total goods exports) has slowly dwindled from 14.8% in 2000 to 10.5% in 2013, before climbing back slightly to 11.5% in 2017. This trend is particularly interesting since it is evident despite the positive effects of the ITA declaration, which aimed to reduce tariffs and other barriers on all imports covered by the Agreement. Consequently, in two decades, the world's IT exports more than tripled and to date represent 15% of total merchandise exports, exceeding the shares of, for example, automotive products and pharmaceuticals. Moreover, the ITA has deepened the convergence of developing

Figure 6.2. ICT services exports (USD million) – change by country income groups, using the average value of the base years 1990–95 as reference 100%
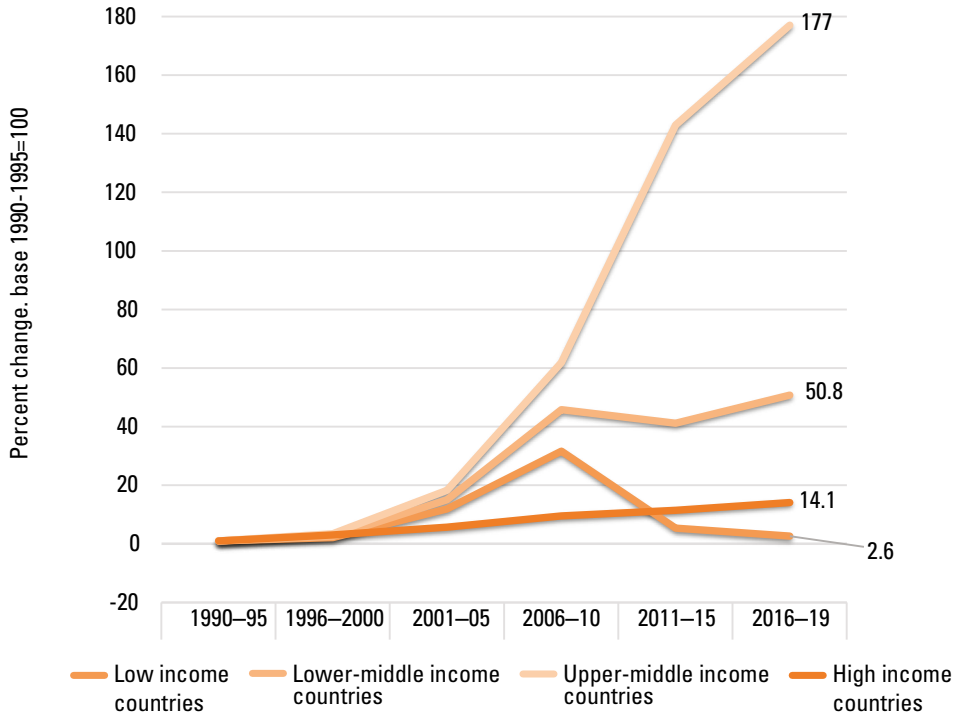
Source: Author's calculation using data extracted from the UNCTADstat database.

economies in global production networks, boosting the proportion of IT products exports from 26% to 63% (WTO, 2017).

As a result, the share of ICT goods exports as a proportion of the total goods exports has decreased from 15.7% in 2000 to 10.2% in 2019 in high-income countries (Figure 6.4). The same share increased moderately from 4.7% to almost 6% in lower-middle income countries, and from around 14% to 16% in upper-middle income countries. However, exports of ICT goods are concentrated in a few economies showing significant growth. Employment levels in ICT manufacturing shrank in the majority of countries (particularly in Norway, Canada, Japan, Australia and

the EU), but grew in a few middle-income countries, mainly thanks to benefits bestowed by the ITA, but also due to the development of specific labour market characteristics (e.g. in India, China, Brazil) over the past two decades.

Annex 6.2 presents the top 10 exporters of ICT goods in 2018 based on several variables. From first to tenth they are: China, Hong Kong, the USA, South Korea, Singapore, Germany, Malaysia, Mexico, Japan and the Netherlands. This top 10 list, which captures 99.6% of overall ICT goods exports, includes 6 Asian countries. China has become the largest exporter with a 38% share in the market, expanding its ICT goods exports from 17.7% in 2000 to 27.4% in 2018.

Figure 6.3. ICT services exports vs. ICT goods exports in EU-27 as a share of total services and goods exports (annual averages of 2000–09 vs. annual averages of 2010–18)

ICT services exports (as share of total services exports)

Country	Annual average 2010-18	Annual average 2000-09
Ireland	66.5	58.8
Sweden	46.6	40.9
Finland	46.4	42.1
Belgium	43.6	34.1
Germany	38.9	32.7
France	37.6	34.6
Romania	37.0	28.9
Netherlands	36.4	35.0
EU	34.9	30.5
UK	34.6	31.9
Czechia	31.6	21.4
Poland	31.5	18.9
Italy	31.4	28.7
Austria	29.8	24.9
Hungary	28.8	20.8
Slovakia	28.1	18.4
Estonia	26.8	17.2
Spain	26.6	
Malta	22.9	17.9
Slovenia	22.3	19.2
Latvia	21.7	17.4
Bulgaria	21.2	14.2
Portugal	20.8	15.3
Luxembourg	20.1	14.5
Denmark	17.8	16.2
Cyprus	16.0	19.6
Lithuania	11.5	9.4
Greece	8.5	6.8

■ Annual average 2010-18
■ Annual average 2000-09

Figure 6.3. (Continued)

ICT goods exports (as share of total goods exports)

Legend:
- Annual average 2000-09
- Annual average 2010-18

Data shown in chart:

Country	Annual average 2000-09	Annual average 2010-18
Bulgaria	1.6	2.5
Slovenia	1.9	1.8
Latvia	2.5	8.3
Greece	2.9	2.3
Italy	3.1	1.9
Spain	3.6	1.4
Romania	3.8	4.9
Belgium	4.0	2.0
Lithuania	4.3	3.1
Poland	5.3	7.5
Austria	5.3	3.9
Denmark	5.6	3.5
France	6.7	4.1
Portugal	7.0	3.2
Germany	7.1	4.7
Luxembourg	7.5	2.5
Cyprus	8.0	5.7
EU	8.5	5.4
Slovakia	9.5	17.1
Sweden	10.9	7.4
Czechia	11.3	13.9
UK	12.2	4.4
Estonia	13.8	11.1
Netherlands	15.0	11.2
Finland	17.8	3.5
Ireland	24.1	6.5
Hungary	25.0	15.7
Malta	50.1	19.4

Source: Author's calculation based on data from UNCTADstat database.

Furthermore, the share of ICT goods exports out of the total goods exported in that year reached 45% in Hong Kong, 21% in South Korea, 32% in Singapore and 30% in Malaysia, compared to a combined share of 26% in the EU and the US. The number of ICT manufacturing employees reached to 4.55 million in China and over 504 000 in South Korea.

While most advanced economies have lost manufacturing jobs since the 1990s, employment in services is generally on the rise (Lund et al., 2019). This trend is apparent for both genders, although, women's participation in the services sector is notably higher than men's. The labour statistics reveal that the share of men employed in services out of the total male workforce grew from 34.5% in the early 1990s to 44.3% in 2017,

while the same proportion for women rose from 40.4% to 55.3%. Yet, an in-depth examination of the country income groups reveals that rich countries have abundant skilled labour, with both male and female participation showing dramatic growth in high-income countries, compared with a decline in the availability of skilled workers in other, poorer regions. This confirms the fact that low productivity activities often relocate to low-wage economies while skill-intensive activities move to more developed countries.

The structural deviation in ICT-based services is reshaping current ICT employment trends. The share of employment in ICT services grew to 80% of the total ICT sector's workforce in 2019, corresponding to 39.3 million employees (2% of the global

Figure 6.4. ICT goods exports (% of total goods exports), by country income groups

	Lower-middle income countries	Upper-middle income countries	High income countries
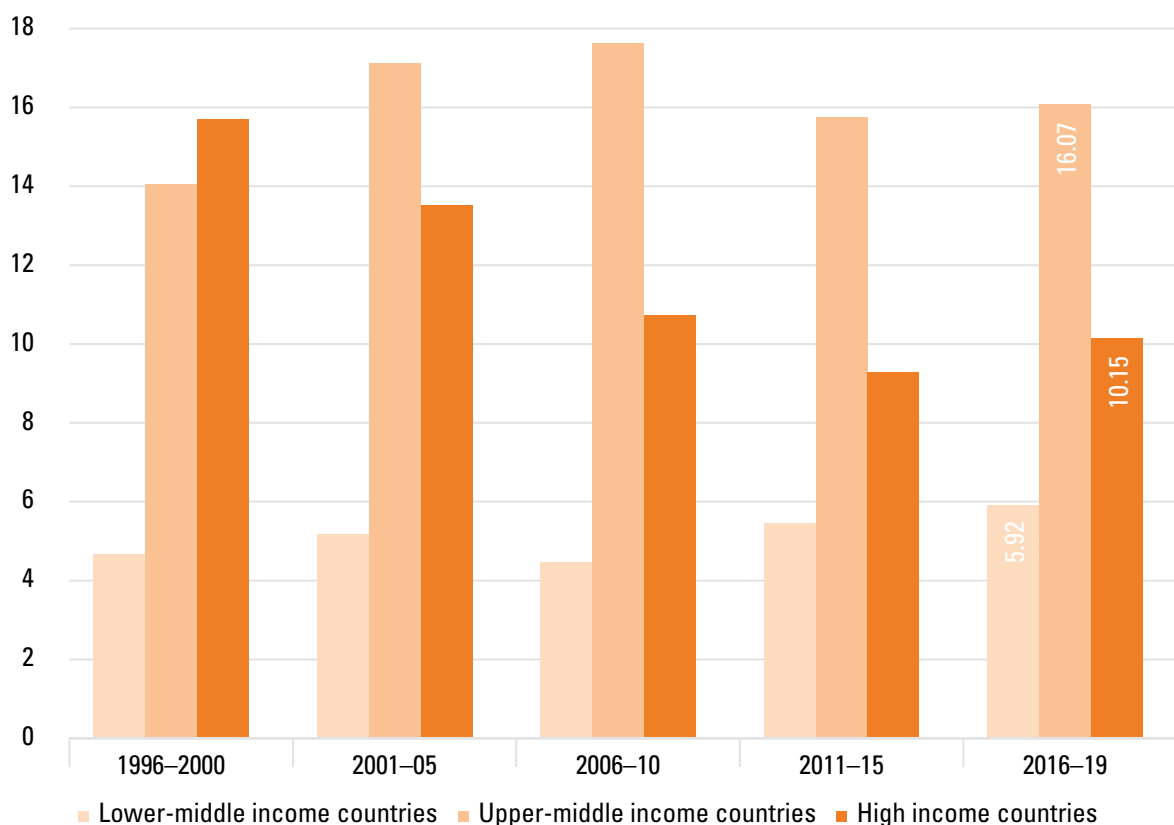
Source: Author's calculation using data extracted from the UNCTADstat database.

workforce). Among the sub-sectors, employment in computer services has grown by 27% since the early 2000s, and constitutes the largest share (38%) of the ICT labour force, compared with 31% each for telecommunications and ICT manufacturing respectively. While the number of those employed in ICT services expanded in almost all countries, the degree of growth was uneven. For example, employment in ICT services in the US has risen by 61% since 1995, while the EU experienced growth of 100% and Israel 238% (Figure 6.5). In the EU, the number of ICT services employees has increased by 42.8% since 2000 (currently standing at 7 million employees). The corresponding numbers of manufacturing employees shrank by 42.4% (643 000 employees). Annex 6.1 shows employment growth in ICT services between 2008 and 2018 for the top 10 countries, up to 53% in India and 39% in China.

The ICT sector depends heavily on high-skilled employees with technological competencies, many of whom perform R&D activities. The number of **business R&D researchers** in the ICT services (full-time equivalent) has shown a substantial growth over the years, although this trend is not evenly distributed across countries. For instance,

while the number of high-skilled IT workers in the EU-27 has tripled, to 155 000, since 2000, the US reported a modest rate of 40%. At the same time, the number of R&D researchers in the EU manufacturing sector dropped from 70 000 to 50 000. Overall, nearly two-thirds of EU ICT specialists have a tertiary level of education, ranging from 33% in Italy to 82% in Ireland. However, the high-skilled ICT specialists are characterised by **deep gender imbalances**. Of the total number of those employed as ICT specialists in the EU, 83.5% are men. The number of male ICT specialists has grown annually by 4.2% over the past decade, while the equivalent figure for women is only 0.5%[4].

Labour productivity performance in the ICT services sector is significantly higher in high-income countries compared to upper-middle income countries. In the 5th percentile the labour productivity value amounts to USD 92 100 compared to USD 37 600, while in the 10th percentile, the corresponding values are

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4   For more information, see: https://ec.europa.eu/eurostat/statistics-explained/index.php/ICT_specialists_in_employment

Figure 6.5. Employment growth in ICT services – Israel vs. EU-27, US and Japan, year 1995 = 100%
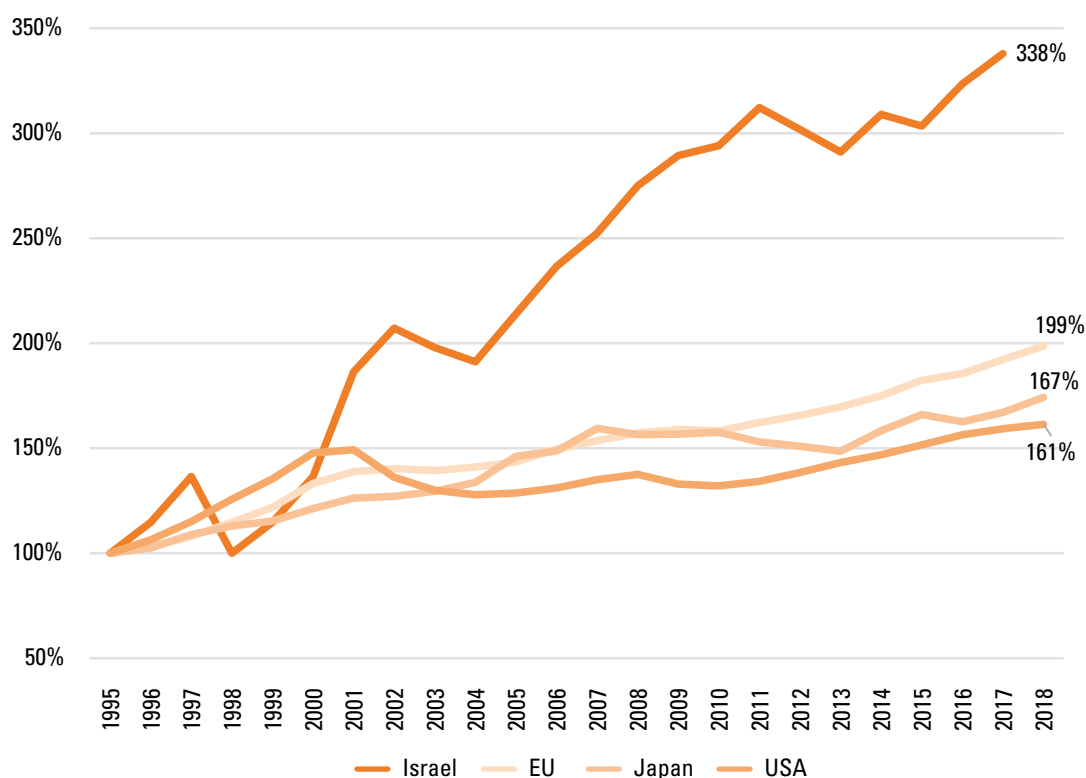
Source: Author's calculation using PREDICT project and Israel CBS (NACE Rev. 2. 582, 61, 62, 631, 951).

USD 134 400 and USD 58 100 respectively. Labour productivity in the ICT services is twice that of the ICT manufacturing sector in upper-middle income countries (based on the author's calculation). Labour productivity in the EU is also considerably higher in the ICT services sector compared to the ICT manufacturing sector: EUR 99 000 per person employed in 2018 against EUR 81 100 (with Ireland having the highest ratio of labour productivity). The sub-sectors with the highest ratios are telecommunications, software publishing and computer programming.

The development of the ICT sector depends on public support, especially the R&D finance programmes in the early evolutionary stages. Indeed, a continuous expansion of ICT R&D public funding has been observed over recent years, particularly in the EU, representing a 6.5% share of the total **government budget allocation for R&D** in 2017. According to the European Commission's PREDICT[5] initiative, the government budget

allocations for ICT R&D has risen annually by 2.6% since 2006, reaching EUR 6.7 billion in 2017, with a greater proportion allocated to ICT manufacturing. Telecommunications and software publishing are the main beneficiary sub-sectors, constituting about 90% of all ICT R&D allocations. Furthermore, the private sector is also increasing its **business R&D expenditure**, with higher volumes going to ICT services, compared to ICT manufacturing. The largest contributors to business R&D expenditure are Germany, the UK, France, Italy and Finland.

6.3.2 ICT services exports in Israel
The case of Israel serves as a robust example of the recent developments in the ICT domain. A young and small country with hardly any natural resources apart from human capital, Israel has turned into a global ICT player and one of the world's largest

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[5]   PREDICT (Prospective Insights on R&D in ICT) is an initiative of the European Commission and the Joint Research Centre that was launched in 2006. It analyses on a regular basis the supply of information and communications technologies (ICT) and research and development (R&D) in ICT in Europe, with comparisons

of major worldwide competitors. ICTs are indeed the technologies underpinning the digital economy, and the PREDICT dataset and its accompanying reports provide a permanent tool for monitoring the ICT sector. The 2019 PREDICT dataset represents the most comprehensive information source available on ICT industries and R&D, covering topics such as employment, public expenditure on R&D and productivity, and is also a reference point for the EU Digital Agenda Scoreboard. See: https://ec.europa.eu/jrc/en/identities/predict-prospective-insights-rd-ict

Figure 6.6. Israel's ICT services exports vs. ICT goods exports (USD million)

ICT goods exports ICT services exports
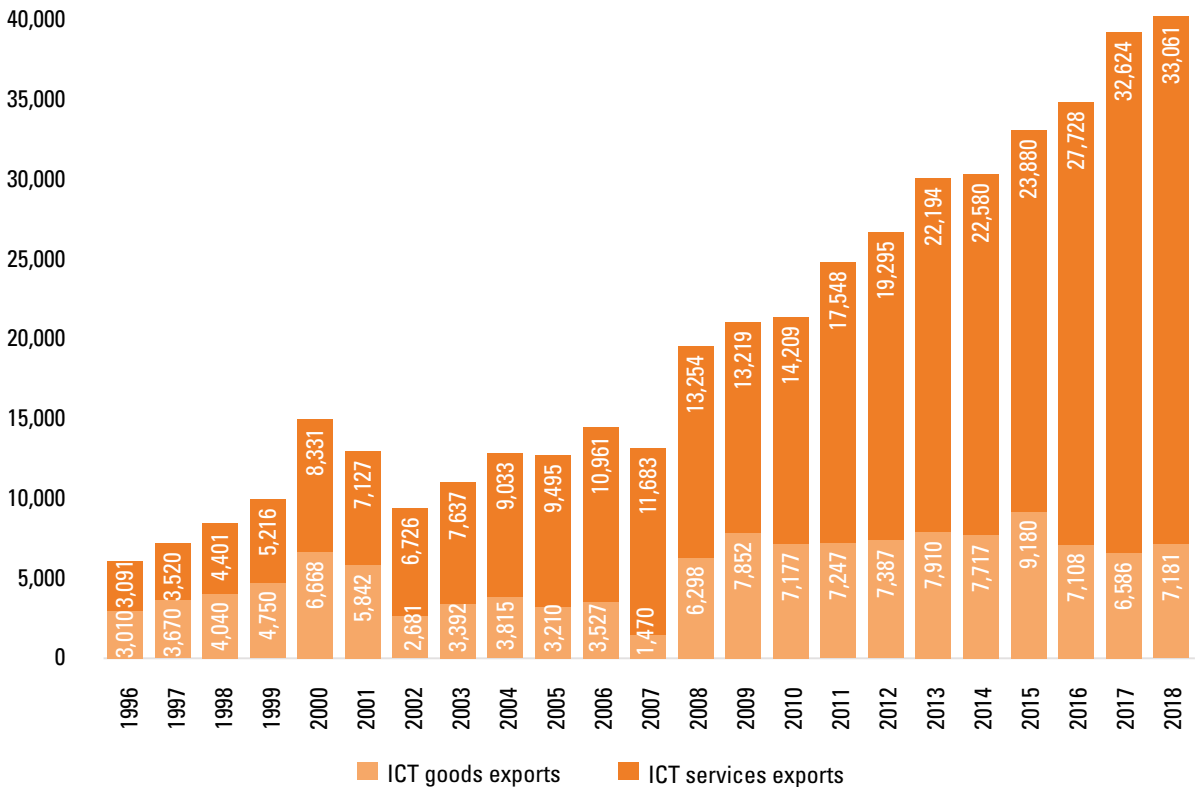
Source: Author's calculation using the World Bank data.

Figure 6.7. Share of ICT services exports out of total services exports – Israel, EU-27, USA and Japan

Israel EU USA Japan
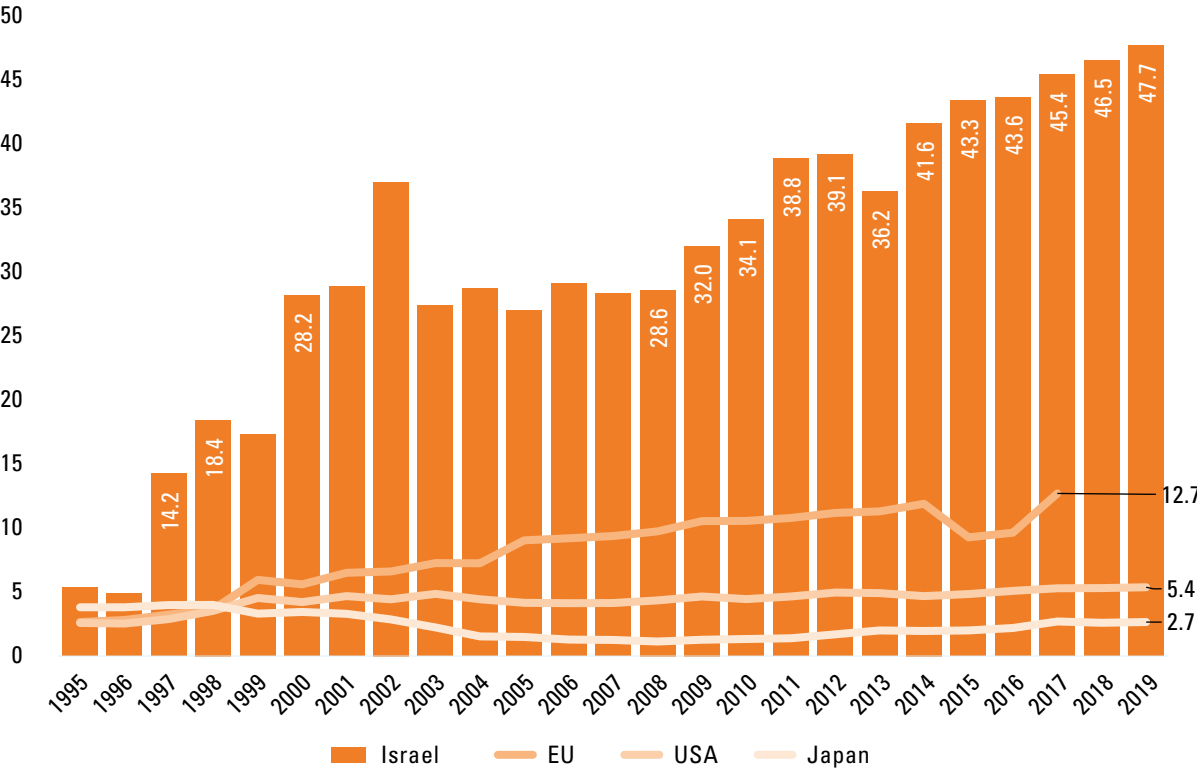
Source: Author's calculation using the World Bank data.

technological powerhouses in less than three decades. Since the mid-1990s, Israel has increased its ICT services exports more than twelve-fold, from a value of USD 2.7 billion to USD 33.1 billion, while ICT goods exports have remained relatively stable, accounting for USD 7.2 billion in 2018 (Figure 6.6).

Israel's share of ICT services exports out of the total services exports is particularly remarkable compared to the performance of the EU, the US and Japan (Figure 6.7). Overall, Israel is responsible for 3.2% of global ICT services exports, which made up, on average, 62% of its total service exports between 2008 and 2018 (Annex 6.1). Despite the disadvantages it faces in terms of a relatively small domestic market and geographically remote trading partners, Israel has achieved an outstanding performance in ICT services exports. Its success in this field is due to a number of factors. First and foremost, individual creativity, technological innovation and business-driven development are at the heart of Israel's ecosystem. Known worldwide known as 'the start-up nation', Israel is a global leader in terms of the number of start-ups per capita in the country (Israel Innovation Authority, 2019). Its high level of entrepreneurship has been also recognised

by the Global Innovation Index 2019, in which Israel is 10th on the overall worldwide list. Furthermore, its ranking is particularly high in the fields of patents (second), business sophistication (third) and knowledge and technology outputs (seventh) (WIPO, Cornell University and INSEAD, 2019).

A second success factor is the government's focus on and commitment to achieving an effective dominance in ICT. Governmental policies supported by special funding schemes were designed to leverage the R&D capacities of the private sector, mitigate entrepreneurs' risks, mostly at the early pre-seed stage, and later turn research initiatives into cutting-edge technological solutions. These public policies include the development of technological incubators and venture capital programmes, as well as providing investment incentives to attract leading foreign multinationals and enhancing international R&D collaboration through the European framework programmes and bilateral agreements with other countries (Getz et al., 2016). Recent evidence by the OECD shows that Israel's **gross domestic expenditure on R&D** (GERD) accounts for 4.94% of GDP, which is higher than any other OECD member[6] (Figure 6.8).

Figure 6.8. Gross domestic expenditure on R&D (as a % of GDP), for selected countries
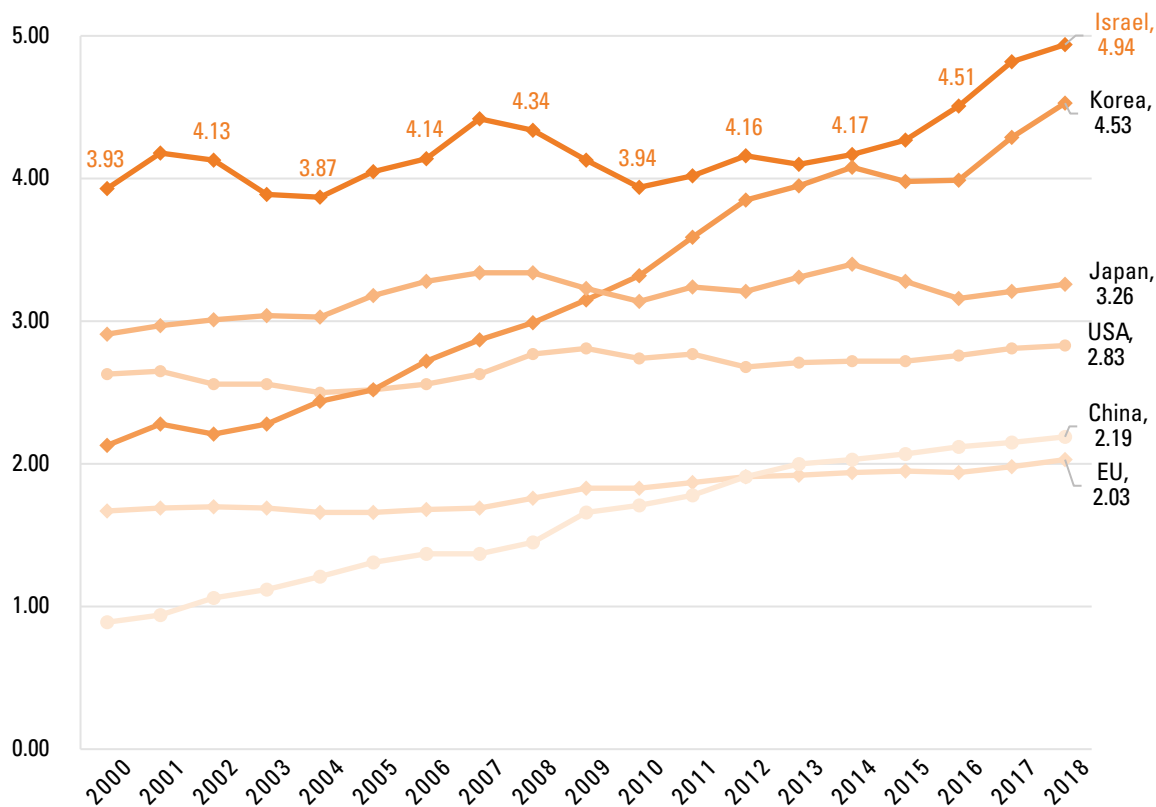
Source: OECD data.

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[6]   For the complete OECD comparison, see data at: https://doi.org/10.1787/data-00182-en

Moreover, the widespread availability of venture capital in Israel was also found to be significant in the expansion of its ICT sector. According to the Global Innovation Index 2019, the country ranks third in terms of venture capital deals as a share of GDP (WIPO, Cornell University and INSEAD, 2019).

A third factor in Israel's success is the country's well-known **top-class scientific research institutions**, and the fact that higher education in Israel has been increasing in scale over the past three decades. Compared to the 1989/90 school year, when 88 800 students were enrolled in 21 Israeli academic institutions, in 2019/20 over 316 600 students were studying at 61 institutions (Council of Higher Education, 2020). Israel has the world's second highest proportion of citizens with higher education: approximately 50% of Israelis have a higher education qualification, behind only Canada (58%) and ahead of the United States and Ireland (48% and 47%, respectively), while the average for OECD members stands at about 38% (OECD, 2019). Accordingly, the average number of researchers per million of the country's inhabitants is the highest among all top 10 exporters of ICT services at nearly 8 000[7]. For comparison, Ireland, the top exporter, has around 4 200 researchers per million inhabitants, while the figure for India is 196 (see Annex 6.1).

Most of the employees in the knowledge-intensive services such as ICT typically hold a Bachelor's degree or above (Lund et al., 2019). In line with the growth in Israel's higher education system, the number of employees in its ICT services has risen by nearly 700% in less than three decades. Compared to 55 700 employees in its ICT sector in 1990 – out of which 35% were working in services and the rest in manufacturing – in 2017 the sector employed 203 700 people, approximately 77% of whom were engaged in supplying ICT services. The availability of high-skilled workers in Israel is greater compared to other developed countries. Employment in ICT services accounts for 4.1% of the total employment in Israel, while the equivalent rate in the EU and the US is 2.3%, and 2.2% in Japan.

Other factors behind the exceptional performance of the Israeli ICT services sector include the growing research collaboration between academia and industry, which is ranked second in the Global Innovation Index. In addition, the fact that female participation in the total Israeli workforce has been

on the rise for the past two decades has contributed to the success of the sector. Evidence that women with advanced degrees are highly valued in the high-tech sector is found in the Global Innovation Index, which lists Israel in third place in this regard (WIPO, Cornell University and INSEAD, 2019).

6.4 Labour demand in the ICT services sector: an economic analysis

This section presents the methodology used to identify the main determinants of labour demand in ICT manufacturing and services exports. An empirical cross-country panel is constructed below to show the contribution of ICT services exports to employment, first at the global level, and then across country groups and by gender. In a second stage, the cross-country panel is employed with additional explanatory factors – such as higher education, wages, public R&D spending, trade openness and investment freedom – to assess job creation opportunities in these sectors (Section 6.4.2). The case of Israel is analysed specifically to check how these variables affect labour demand (Section 6.4.3) and the findings are compared to those of a similar analysis carried out for countries of the EU-27 (Section 6.4.4). This comparison differentiates between the situation in ICT services and ICT goods. This is followed by the final section highlighting the article's conclusions and the possible policy implications of its empirical findings. When checking cross-country variation and country income groups, it is interesting to see how changes in the export levels of each ICT sub-sector are intertwined and correlated with labour demand.

6.4.1 Methodology and data
For the econometric analysis, an empirical model was developed based on the theoretical foundations of the conventional constant elasticity of substitution (CES) production function with two input factors, namely labour and capital (Hamermesh, 1996). The model's main assumption is that perfect competition exists in both the goods and factor inputs markets, that is, exogenous prices for workforce, while capital is assumed to be quasi-fixed. We derive the first-order condition from the optimal labour demand function, take logs on both sides of labour demand function and add an error term to generate a log-linear labour demand function, which takes the following specification:

$$\ln\_EMP_{scg} = \beta 0 + \beta 1 \ln\_ICT\_Serv\_Exports + \beta 2 \ln\_ICT\_Goods\_Exports + \beta 3 \ln\_Public\_R\&D + \beta 4 \ln\_Trade\_Openness + \beta 5 \ Investment\_Freedom + \beta 6 \ln\_Education + \beta 7 \ln\_Female\_ICT\_Specialist + \beta 8 \ln\_Wage + e_{scg}$$

The dependent variable is EMP which denotes the employment demand in the ICT services or manufacturing sectors and the small letters '*c*', '*s*' and '*g*' denote the country, sector and gender, respectively. It is assumed that output can be approximated by ICT services and goods exports. In order to account for the likely impact of ICT services and goods exports, the labour demand equation is augmented by various ICT indicators and other variables that could potentially explain changes in workforce demand. These additional control variables include public funding for R&D, human capital, and wages, among other factors. Also, an error term '*e*' is added to allow for random shocks that affect labour demand. The empirical model builds on data assembled from multiple sources, including ILOSTAT, the World Bank and national statistical offices. A description of the variables used in the econometric model along with their sources is given in Annex 6.3. Particular information on the ICT sector has been extracted from the EU-funded project PREDICT.

6.4.2 Econometric analyses and results

This section begins with an estimation of the correlation between employment levels and ICT services exports at the global level in the period 1990–2018. As the data is in natural logarithm form, the coefficient represents the elasticity of labour demand with respect to ICT services exports. The results presented in Table 6.1 are sufficiently significant, indicating that a 10% increase in global ICT services exports is correlated with a 6.6% rise in demand for employment in ICT services.

To illustrate the predicted outcome, we generated the fitted values for the estimation, as depicted in Figure 6.9.

In the second stage, the analysis is augmented by using various explanatory variables to explain the labour demand in the ICT service sector. The results presented in Table 6.2 are divided into four groups, and differentiated by gender, thus comprising eight models in total. The first two models include all available countries (968 observations). Models 3 and 4 include 82 ITA members, according to accession year. Models 5 and 6 examine the 27 EU Member States and the last two models consider 14 Asian countries, including China, India, Singapore, Australia, Japan, South Korea, Hong Kong, Malaysia, the Philippines and Indonesia. The model's goodness of fit is satisfactory, as the regressors capture approximately 46–74% of the variations in employment levels. Unless specified otherwise, the coefficients are presented in the logarithm form, hence representing the elasticity of labour demand with respect to the specified control variables in the ICT services sector. The main findings are discussed extensively below.

As the core objective is to show the impacts of ICT exports on employment, attention is given first to the two control variables: ICT services exports and ICT goods exports. The category **ICT services exports** (as a percentage of total services exports) shows a positive statistical significance in nearly all country groups, particularly for women among ITA members and in both genders for the EU sample. The strongest impact is in the EU, where a 10%

Table 6.1. Elasticity of labour demand in the ICT sector

Source		SS	df	MS				Number of obs	=	704
								F(1, 702)	=	880.40
Model		1205.8621	1	1205.862				Prob > F	=	0.0000
Residual		961.50976	702	1.369672				R-squared	=	0.5564
								Adj R-squared	=	0.5557
Total.		2167.37183	703	3.0830325				Root MSE	=	1.1703
EMP_ICT_Services		Coef.	Std. Err.		t	P>|t|		[95% Conf. Interval]		
ln_ICT_Serv_USD		.6638	.02237		29.67	0.000		.619862		.707706
_cons		-9.313	.475092		-19.60	0.000		-10.2454		-8.37989

Source: Author's calculation using data from UNCTADstat database.

Figure 6.9. Elasticity of labour demand in the ICT services sector as a factor of services exports
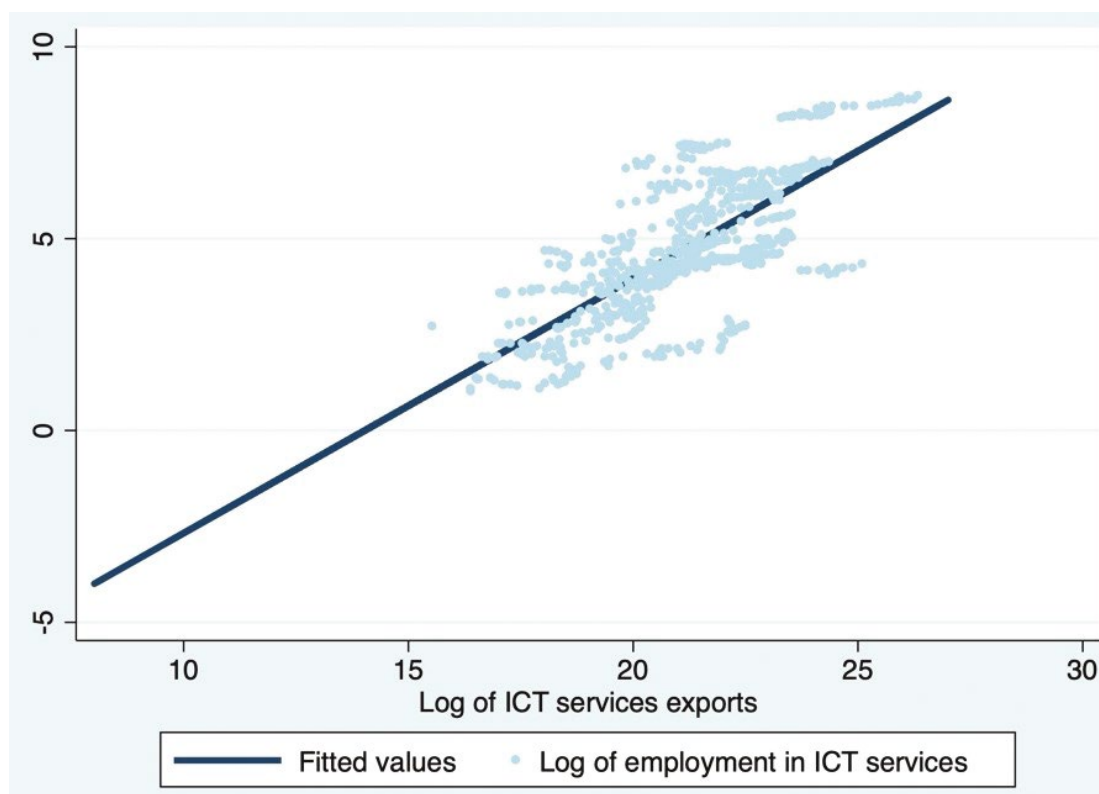
Source: Author's calculation using data from PREDICT project and UNCTAD.

increase in ICT services exports is associated with a 9–10% expansion of employment in ICT services. In concrete terms, a rise in the share of ICT services exports from 37% to 40% (in overall services exports) would result in an additional 16.5 million employees in the services sector, of which 8.8 million are projected to be women. The **share of ICT goods exports** (in total goods exports) co-varies positively with employment levels in the services sector, except for the EU-27. The strongest positive effect is found in the Asian countries, where a 10% increase in the share of ICT goods exports is associated with 3–4% expansion of employment in ICT services. This may be explained by the fact that if a country specialises in exporting ICT goods, it tends to increase the support services it provides (i.e. after sales and customer support), which leads to higher labour demand in this area.

Public funding for R&D plays a meaningful role in increasing labour demand in ICT services. This positive statistical correlation suggests that the more **governments invest in R&D**, the higher the probability of seeing growth in employment demand in ICT services. Specifically, a 10% increase in public expenditure on R&D (as a percentage of GDP) is associated with a 4–4.7% rise in employment. Another finding is that **trade openness** is robust

among all country groups, although showing negative signs of the coefficients. When more countries engage in the global markets, labour demand in the ICT services sector declines, albeit implying a weak correlation since the coefficients are relatively low, meaning that this finding should be treated with caution. A noteworthy contribution is the negative and significant coefficients found for the **investment freedom** variable, which measures how economically free countries are in terms of regulatory constraints on investment flows. This finding suggests that eliminating investment barriers hampers employment growth, which may indicate the importance of the gradual implementation of any investment liberalisation policy due to the adverse social impact it could have on the labour market.

Given that the ICT services sector largely relies on high-skilled employees, labour demand is expected to increase proportionally with the number of schooling years acquired. Indeed, the contribution of education, as shown using the **human capital index** is positively correlated with employment levels in ICT services, particularly for women. Thus, the more years of schooling completed and the higher the numbers of learners returning to education, the more likely it is that employment

Table 6.2. General results: employment in the ICT service sector

VARIABLES	THE WORLD		ITA MEMBERS		EU-27		ASIAN COUNTRIES	
	MALE (1)	FEMALE (2)	MALE (3)	FEMALE (4)	MALE (5)	FEMALE (6)	MALE (7)	FEMALE (8)
ICT services exports	0.127 (0.066)	0.209** (0.064)	0.117 (0.087)	0.302*** (0.07)	0.942*** (0.084)	0.984*** (0.083)	0.0464 (0.088)	-0.144 (0.082)
ICT goods exports	0.193*** (0.026)	0.171*** (0.025)	0.194*** (0.04)	0.171*** (0.0348	-0.157* (0.066)	-0.121 (0.063)	0.304*** (0.039)	0.398*** (0.041)
Public R&D	0.476*** (0.061)	0.413*** (0.054)	0.469*** (0.079)	0.402*** (0.068)	0.245* (0.113)	0.253* (0.106)	0.648*** (0.097)	0.332*** (0.099)
Trade openness	-0.014*** (0.001)	-0.014*** (0.001)	-0.012*** (0.001)	-0.012*** (0.001)	-0.012*** (0.001)	-0.013*** (0.001)	-0.009*** (0.001)	-0.01*** (0.001)
Investment freedom	-0.941*** (0.0911)	-0.779*** (0.0945)	-0.816*** (0.171)	-0.547*** (0.158)	-0.188 (0.356)	0.0505 (0.344)	-1.702*** (0.246)	-1.635*** (0.255)
Education (human capital)	-0.228* (0.105)	0.428*** (0.113)	0.0792 (0.146)	0.801*** (0.145)	0.608*** (0.134)	0.708*** (0.128)	-1.635*** (0.154)	-0.07 (0.178)
Wages and salaries	-0.014** (0.004)	-0.019*** (0.003)	-0.033*** (0.007)	-0.039*** (0.005)	-0.03*** (0.007)	-0.032*** (0.008)	0.015** (0.005)	-0.0035 (0.004)
_cons	13.90*** (0.515)	11.44*** (0.483)	13.78*** (0.797)	10.51*** (0.712)	6.953*** (1.523)	6.053*** (1.446)	19.28*** (1.11)	15.42*** (1.129)
N	968	968	671	671	384	384	163	163
R²	0.462	0.478	0.473	0.547	0.633	0.69	0.739	0.638

Notes: Standard errors in parentheses. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Source: Author's calculation using data from UNCTADstat database and other data sources provided in Annex 6.3.

in services will increase. Interestingly, human capital has a stronger effect on the employment of women compared to men across most country groups. Lastly, we observe that in line with existing economic literature, **wages and salaries** are inversely correlated with labour demand. As expected, the higher the wages and salaries, as a share of aggregate labour cost, the more the elasticity of labour demand declines. Yet, it should be noted that the magnitude here is relatively small, irrespective of gender.

6.4.3 ICT services and labour demand: the case of Israel
This section looks at the relations between employment demand and various factors related to the ICT sector in Israel over the past three decades. It starts with presenting the pairwise correlation coefficients matrix, based on a statistical analysis using the Pearson correlation

method, at the 5% significance level. The results in Table 6.3 demonstrate the relatively high and positive correlation between employment levels in ICT services and nearly all explanatory variables. Notably, labour demand in the ICT services sector is highly correlated with ICT services exports as well as with the Israel's government expenditure on tertiary education and with years of schooling (human capital). Though still very high, labour demand in the ICT services sector is positively associated to a lesser extent with government support for ICT R&D.

It is clear from the correlation coefficients matrix that public expenditure, whether directly related to R&D or tertiary education, is substantially higher with respect to ICT services exports compared to exports of ICT goods. This highlights the extent to which Israeli public incentives foster labour demand in the ICT services sector. Moreover, in both the goods and services sub-sectors, indirect support

Table 6.3. Correlation coefficients significant at the 5% level

	ICT SERVICES EMPLOYMENT	ICT SERVICES EXPORTS	ICT GOODS EXPORTS	GOVERNMENT EXPENDITURE. ON R&D	GOVERNMENT EXPENDITURE ON TERTIARY EDUCATION	HUMAN CAPITAL (SCHOOLING)	WAGES PER EMPLOYEE
ICT services employment	1.000						
ICT services exports	0.8882*	1.000					
ICT goods exports	0.6217*	0.7024*	1.000				
Government expenditure on R&D	0.8186*	0.7623*	0.4035	1.000			
Government expenditure on tertiary education	0.9212*	0.9526*	0.6262*	0.6596*	1.000		
Human capital (schooling)	0.9206*	0.9871*	0.7242*	0.8053*	0.5184*	1.000	
Wages per employee	0.572	0.9527*	-0.0578	0.8674*	0.9547*	0.8640*	1.000

Note: * The correlation is significant at the 5% level.

Source: Author's calculation using data from UNCTAD and the Israeli Central Bureau of Statistics.

for higher education may be even more beneficial than direct funding for R&D. In addition, we note the positive relation between ICT services exports and ICT goods exports (0.7024), which implies the existence of a complementary interaction between the ICT services and goods exports. This finding is fascinating since, in most countries, the success of the ICT services sector often comes at the expense of a shrinking ICT manufacturing industry. The fact that a substitution effect does not occur in Israel upholds the importance the country gives to the ICT manufacturing sector. Evidence for the relatively stable volumes of Israeli ICT goods exports over the years are shown in Figure 6.6.

The correlation between the human capital index and other ICT-related variables indicates that a longer duration of schooling is associated with higher employment demand and a more robust performance in terms of ICT services exports. Furthermore, a noticeable high and

positive correlation is found in Israel between wages per employee in the ICT services sector and three economic variables (ICT services exports, public expenditure on R&D, and public expenditure on tertiary education). Firstly, wages are almost perfectly correlated with ICT services exports, which implies that a growth in ICT services exports supports a high likelihood of an increase in wages. Secondly, wages per employee in the Israeli ICT services sector are highly and positively associated with government expenditure, both on research and development activities, as well as on tertiary education. These two correlations suggest that public policies applied by the government not only enhance ICT services performance but also provide welfare gains for individual employees.

The next step is an econometric analysis to assess the elasticity of **labour demand** in Israel's ICT services sector with respect to several variables,

including ICT services and goods exports, ICT gross expenditure on R&D, and national funding for tertiary education and human capital. The results (shown in Figure 6.10) confirm the dramatic positive effects on labour demand in the ICT sector of Israel's national financing schemes for R&D and tertiary education. These findings provide an opportunity for comparing the elasticities in Israel to different country groups, for example the EU-27 Member States, as discussed in the next sub-section. Except for the elasticity of labour demand with respect to ICT goods exports, the goodness of fit of the statistical model is relatively high in all specifications, ranging from 68% to 85%, and thus the variations in terms of employees are explained by the regressors specified. First, particularly noteworthy is the fact that labour demand elasticities with respect to the control variables in Israel's ICT services sector are substantially higher than those found in other country groups. This demonstrates not only the high importance of the ICT services sector to the Israeli economy, but also the significant role that the country's government has played in boosting its performance.

The upper left corner of Figure 6.10 illustrates the elasticity of labour demand in the ICT services sector with respect to its exports. Here, a 10% increase in ICT services exports is associated with a 3.5% rise in employment levels in ICT services. The elasticity of labour demand in ICT services

with respect to ICT goods exports is similar to previous findings, albeit with a significantly lower R2. After checking the labour demand elasticity with respect to public spending on ICT R&D, 20.7% more employees are found for every 10% increase in public allocation, compared to 6–8.3% in the EU. In absolute terms, this could be translated into around 32 000 additional employees in Israel. An additional positive impact is found in the area of national expenditure on tertiary education, where a 10% expansion could increase employment in ICT services by 37%, equivalent to some 57 000 employees. Lastly, the most substantial link is that between elasticity of labour demand in the ICT services sector and years of schooling. Here a 10% change in the level of education leads to a 70% higher probability of being employed in the ICT services sector. The latter three elasticities clearly demonstrate the considerable role of government engagement in boosting labour demand in the case of the Israeli ICT services sector.

6.4.4 A robustness check: the European Union
An in-depth empirical analysis of labour demand was carried out on the **EU-27 ICT sector** to test the robustness of the research. This analysis is based on a cross-country year-level panel dataset for the years 1990–2019, extracted by the author, primarily from the PREDICT project and other sources provided in Annex 6.3. It allows the various effects on workforce

Figure 6.10. Elasticity of labour demand in Israel's ICT service sector, with respect to five indicators
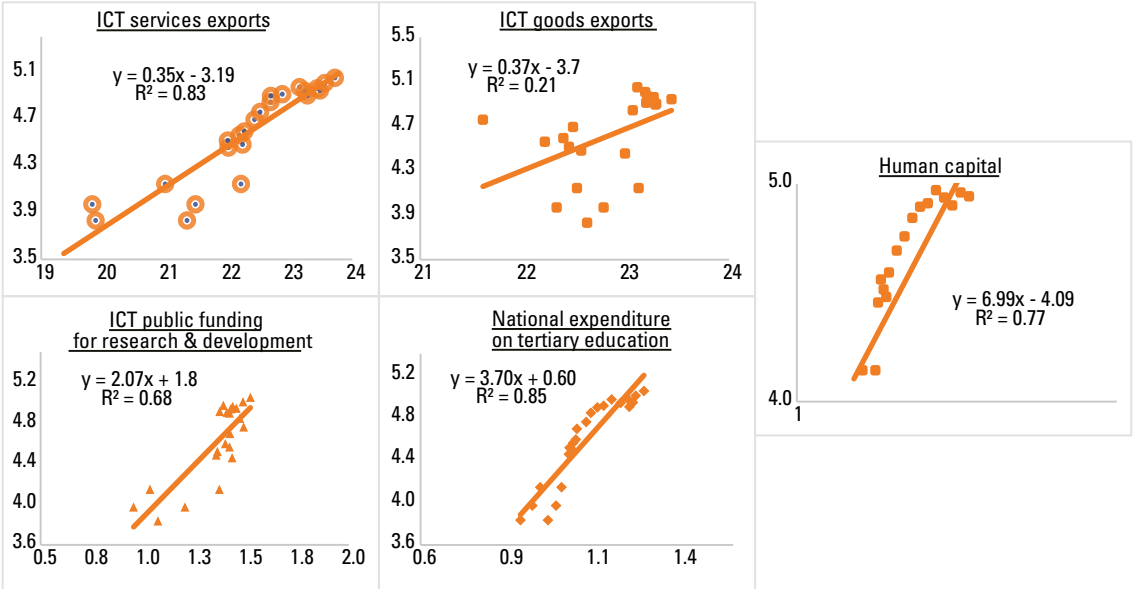
ICT services exports: $y = 0.35x - 3.19$, $R^2 = 0.83$

ICT goods exports: $y = 0.37x - 3.7$, $R^2 = 0.21$

ICT public funding for research & development: $y = 2.07x + 1.8$, $R^2 = 0.68$

National expenditure on tertiary education: $y = 3.70x + 0.60$, $R^2 = 0.85$

Human capital: $y = 6.99x - 4.09$, $R^2 = 0.77$

Source: Author's calculation using data from UNCTAD and the Israeli Central Bureau of Statistics.

trends to be separated into the sectors of ICT services and the ICT manufacturing[8]. To that end, we disentangle the relative contributions to employment levels of exports in ICT services and ICT goods in each of these sub-sectors. The results are presented in Table 6.4. In the first three models (models 1–3) the dependent variable is the log of persons employed in ICT services, while in the last three (models 4–6) the dependent variable represents employees in the ICT manufacturing sector.

First, the goodness of fit of the statistical model is relatively high in all specifications, ranging from 80.7% to 94.1%, thus the variations in terms of employees in both sectors are explained by the specified regressors. Second, the findings confirm the positive statistical significance of both **ICT services and goods exports** on employment in the ICT sector. But the coefficients suggest a more substantial impact of ICT goods exports on employment in ICT services, compared to the

Table 6.4. Employment in the European ICT services vs. ICT manufacturing (EU-27)

	EMPLOYMENT ICT SERVICES SECTOR			EMPLOYMENT ICT MANUFACTURING SECTOR		
	(1)	(2)	(3)	(4)	(5)	(6)
ICT services exports	0.252*** (0.048)	0.257*** (0.047)	-0.151** (0.045)	0.177* (0.076)	0.162* (0.07)	-0.211** (0.077)
ICT goods exports	0.319*** (0.024)	0.322*** (0.024)	0.202*** (0.023)	0.844*** (0.045)	0.838*** (0.044)	0.394*** (0.047)
ICT public funding R&D	0.0836** (0.041)	0.0611* (0.039)		-0.357*** (0.06)	-0.293*** (0.058)	
Trade openness	-1.140*** (0.0917)	-1.204*** (0.0926)	-0.455*** (0.0787)	-1.950*** (0.15)	-1.770*** (0.152)	-0.312 (0.166)
Investment freedom	-0.726*** (0.2)	-0.763*** (0.202)	-0.79*** (0.207)	-1.132*** (0.34)	-1.031** (0.32)	-0.907** (0.344)
Education human capital	0.440*** (0.0995)	0.475*** (0.097)	0.162* (0.0711)	1.118*** (0.162)	1.021*** (0.165)	0.29 (0.182)
Female ICT specialist		-0.01* (0.004)	0.005 (0.003)		0.027*** (0.007)	0.025*** (0.006)
ICT wages			0.695*** (0.06)			0.570*** (0.072)
_cons	-1.335 (0.905)	-0.876 (0.888)	2.869*** (0.772)	-8.288*** (1.676)	-9.576*** (1.592)	-0.767 (1.838)
N	310	310	248	310	310	184
R[2]	0.901	0.903	0.941	0.807	0.816	0.843

Notes: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: Author's calculation using data from the PREDICT project and other data sources provided in Annex 6.3. For PREDICT project, see: https://ec.europa.eu/jrc/en/identities/predict-prospective-insights-rd-ict

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[8] For consistency purposes, in this analysis we use the NACE Rev. 2 (Classification of Economic Activities in the European Community) based on the following codes: ICT services industries = 582, 61, 62, 631, 951; ICT manufacturing industries = 261–264.

extent to which exports of ICT services affect employment in ICT manufacturing. While a 10% growth in ICT services exports is expected to increase labour demand in the ICT manufacturing sector by 1.6–1.8%, a similar expansion in ICT goods exports results in a 3.2% rise in employment in ICT services. As seen in previous results, public funding for R&D is crucial for employment levels in the ICT services sector. In concrete terms, an additional 10% of public R&D funding for ICT can lead to an increase of 400–500 000 employees in the ICT services sector overall. However, the estimations demonstrate a negative correlation with employment in the ICT manufacturing sector that requires further analysis. The estimators on trade openness and investment freedom are consistent with the previous findings.

The correlation of education (measured using the **human capital index**) with both ICT sub-sectors provides evidence for a strong positive impact of schooling on employment levels in the ICT sector, and is higher in manufacturing than services. Moreover, a low positive correlation is found between the share of **female ICT specialists** and labour demand in the ICT manufacturing sector. Hence, the positive statistical significance highlights the relevance of high-skilled ICT employees in the ICT manufacturing industry. Lastly, a strong, positive and statistically based relationship is observed between the share of **wages and salaries** and employment levels in both ICT sub-sectors. The correlation is slightly higher for ICT services, suggesting that a 10% increase in pay in the ICT services sector could result in an expansion of nearly 7% in employment levels, whereas this growth would only amount to 5.7% in the ICT manufacturing sector.

6.5 Conclusions and policy implications

While ICT services exports have experienced a dramatic surge over the past three decades, the trend in ICT goods exports shows a marked decline in high-income countries, although such exports appear to be on the rise in developing countries, especially in Asia. The explanation for this lies partly in the de-industrialisation process taking place in high-income countries, which shifts capacities away from traditional manufacturing industries and towards services. In addition, lower import tariffs for IT products have driven emerging economies (in Asia) to substantially expand their ICT manufactured exports. To a great extent, these conflicting trends shape labour demand within the ICT sector.

This article explores the degree to which ICT services (and exports) impact labour demand across

different income country groups and in relation to gender, and looks at the key determinants for employment in the ICT services sector. The analysis draws on various sources, among which the EU-funded PREDICT project (2019) offers a unique opportunity to construct an empirical framework to explore the country variation effects of ICT services exports on employment. The focus on Israel illustrates its outstanding transformation in recent years to become one of the world's largest exporters of ICT services, while the leading factors that contributed to this outcome are identified. Moreover, the research reported here enhances our understanding of the determinants of employment demand in relation to explanatory variables, including the significance of such factors as public funding for research and development, investment regulation freedom and years of education, among others. It also underlines the positive correlation between ICT goods and services exports on the one hand, and labour demand in the ICT services sector, on the other.

First, the findings validate the idea that building export capacities in ICT services can boost labour demand, with a stronger impact on the employment of women. In high-income countries such as those in the EU-27 bloc, ICT services exports are correlated with labour demand to a considerably greater extent than is the case in Asian countries, where stronger ties are found between labour demand and ICT goods exports. Second, despite the common perception that ICTs operate more effectively in an environment where government intervention is low, this analysis shows the opposite to be the case. It confirms the importance of government initiatives in relation to ICT R&D as forming catalysts for job creation in the services sector, while policy measures taken to eliminate investment regulation have an adverse effect on labour demand. In addition, the analysis highlights the important contribution of the duration of schooling to labour demand, where, again, the effect on female employment is substantially more visible.

Within this context, the case of Israel provides a good illustrative example. It reveals not only a much stronger correlation between employment growth and ICT services performance compared to other country groups, but also the dramatic role that the Israeli government plays in boosting labour demand in the ICT services sector. The government's proactive strategy of supporting innovative initiatives through offering numerous financial incentives for supporting R&D has had a notable impact on employment in the country's ICT services. Its funding for ICT R&D is three times more effective in creating labour demand compared to the EU-27

countries. Israel's labour force in the ICT services sector also benefits greatly from its public funding policy for higher educational attainment. The research here finds that for every 1% increase in public expenditure on tertiary education, employment in ICT services has risen by nearly 4%. Furthermore, the relevance of years of education to labour demand in the Israeli ICT services sector is ten times higher compared to its impact in the EU-27 bloc.

Several policy implications can be derived from the findings of this analysis. First, the importance of government engagement in job creation for the ICT services sector cannot be overstated. Publicly funded support for research and development activities, as well as the allocation of larger shares of national budgets to higher education attainment, could notably boost labour demand in highly skilled sectors such as ICT services, and should thus be prioritised accordingly. This is especially relevant for countries that have shifted from ICT manufacturing to services, as the correlation between public financial support in ICT goods is substantially lower.

Secondly, in nearly all the cases tested, except for the Asian region, the impact of ICT services exports, as well as all forms of public funding, have a more substantial positive impact on female employment. Given the existing gender gaps, this outcome is particularly promising. Lastly, the elimination of investment regulation is adversely correlated to employment growth in the ICT services sector. This suggests a more gradual approach to investment liberalisation policy is warranted, especially in the lower- and middle-income countries.

In terms of future research, firstly public policy measures designed to increase labour demand should be examined to disentangle the effect of each funding mechanism on employees with different ICT skills. Secondly, new research could profitably focus on the potential impact of ICT services on labour demand across industry groups and firms, albeit that much depends on the availability of firm-level data. Finally, further analysis is necessary to understand the relations between the proliferation ICT services and occupational choices, technological capacities and labour productivity.

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Annex 6.1. Top 10 exporters of ICT services in the world, descriptive statistics 2018 (mean values for 2008–18)

	(1) IRE	(2) IND	(3) USA	(4) DEU	(5) CHN	(6) UK	(7) ISR	(8) FRA	(9) NLD	(10) SWE
ICT services exports (mil. USD)	49.406	66.073	32.011	26.476	17.039	23.095	12.732	16.488	13.149	12.768
ICT services exports (annual change)	10.0%	5.2%	7.0%	7.8%	15.4%	3.8%	12.6%	1.8%	3.6%	5.6%
ICT services exports (share in global ICT services exports)	12.5%	16.8%	8.1%	6.7%	4.2%	5.9%	3.2%	4.3%	3.4%	3.2%
ICT services exports (% of total services exports)	65.6%	65.7%	22.9%	38.2%	33.9%	34.2%	62.1%	36.8%	35%	46.3%
Value added, ICT services sector (mil. EUR)	18.263	205.421	561.974	96.536	270.096	84.967	13.100	79.803	27.917	16.303
Labour productivity, ICT services sector (1 000 EUR/person)	259.3	13.8	196.8	97.7	27.9	84.1	N/A	109.1	104.4	102.5
Overall economic freedom*	78.6	54.6	77.1	72.5	53.2	76.3	68.8	63.6	75.0	72.7
Investment freedom score*	90.5	35.9	75	84.5	25.9	90	80	63.6	90	85.9
GDP per capita (USD)	56 478	1 470	52 821	44 067	6 336	42 720	34 179	41 007	51 010	55 186
R&D (total expenditure on R&D, % of GDP)	1.4%	0.8%	2.75%	2.83%	1.9%	1.67%	4.22%	2.21%	1.9%	3.3%
Researchers (per mil.)	4 214	196	4112	4407	1081	4188	7931	4070	4136	6215
Human capital index*	3.07	2.02	3.71	3.66	2.43	3.72	3.63	3.10	3.31	3.37
Income inequality (Gini Index)*	0.30	0.44	0.39	0.29	0.46	0.36	0.36	0.30	0.29	0.27
Expenditure on primary education	36.1%	26.8%	31.4%	13.2%	N/A	30.6%	39.2%	20.6%	23.9%	23.5%
Employees in ICT services (1 000 persons)	69.3	4 309.8	3 809.7	985.8	5 289.4	1 010	143.8	731.1	267.5	157.7
Employment, ICT services (annual growth)	1.8%	5.3%	1.3%	2.2%	3.9%	2.4%	1.3%	1.5%	1.4%	1.8%
Female employment, services (% of female employment)	89.3%	22%	90.4%	84.7%	N/A	90.9%	89.2%	87.5%	84.3%	91.1%
Male employment, services (% of male employment)	64.3%	31.1%	68.3%	58.1%	N/A	68.9%	69%	63.8%	64.1%	66.9%

Note: (*) See the descriptions and/or sources of these indicators in Annex 6.3.

Source: Author's calculation based on data from PREDICT project and other sources, as listed in Annex 6.3.

	(1) CHN	(2) HKG	(3) USA	(4) KOR	(5) SGP	(6) DEU	(7) MYS	(8) MEX	(9) JPN	(10) NLD
ICT goods exports (mil. USD)	523.714	212.343	137.607	105.075	115.504	64.818	62.062	60.167	67.489	57.174
ICT goods exports (annual change, %)	5.7	7.5	1.2	5.9	1.1	0.6	4.1	2.0	-4.2	-0.7
ICT goods exports (% total goods exports)	27.4	45	9.7	20.7	31.8	4.7	30.1	176	9.5	11.4
Labour productivity, ICT manufacturing (1 000 EUR/person)	16.2	N/A	170.1	136.9	N/A	93.0	N/A	N/A	84.3	163.9
Value added, ICT manufacturing sector (mil. EUR)	97763	N/A	118.330	69.051	N/A	13.496	N/A	N/A	62.724	1.714
GDP per capita (USD)	6 336	37 775	52 821	24 741	52 281	44 067	9 834	9 701	41 169	51 009
Overall economic freedom*	53.2	89.7	77.1	70.8	87.9	72.5	68.4	66.1	72.3	75
Investment freedom score*	25.9	90	75	69.5	80.5	85	49	65	65	90
Tariff rate (applied, weighted mean, all products, %)	4.2	N/A	1.7	8.8	0	1.1	4	2	1.7	1.4
R&D (total expenditure on R&D, % of GDP)	1.9	0.75	2.75	3.97	2.18	2.83	1.12	0.51	3.25	1.9
Researchers (per mil.)	1 081	3 076	4 112	6 296	6 421	4 407	1 655	308	5 166	4 136
Income inequality (Gini Index)*	2.43	3.18	3.71	3.55	3.37	3.66	2.93	2.65	3.52	3.31
Expenditure on primary education (%)	N/A	N/A	31.4	32	21.3	13.2	32.2	35.7	34	23.9
Employees, ICT manufacturing (1 000 persons)	4 551.8	N/A	698.6	504.3	N/A	141.5	N/A	N/A	754.2	10.3
Employment, ICT manufacturing (annual growth, %)	4.8	N/A	-2.5	0.2	N/A	-2.8	N/A	N/A	-4.5	-5.0
Female employment, manufacturing (% of female employment)	N/A	N/A	7.9	13.1	16.7	14.5	21.1	17.4	15.4	6.5
Male employment, manufacturing (% of male employment)	N/A	N/A	26.7	24	26.4	40.6	32.1	29.9	33.7	24.8

Note: (*) Please check the descriptions and/or sources of these indicators in Annex 6.3.

Source: Author's calculation based on data from PREDICT project and other sources, as listed in Annex 6.3.

Annex 6.3. Description of variables used in the econometric model and their sources

VARIABLES	DESCRIPTION	SOURCE
Employment in ICT manufacturing industries	Employment in ICT manufacturing sector (in thousands)	2019 PREDICT project https://ec.europa.eu/jrc/en/predict
Employment in ICT services industries	Employment in ICT services sector (in thousands)	2019 PREDICT project
Employment sector/gender	Employment in services/manufacturing, by gender (% of all employment)	International Labour Organisation, ILOSTAT
ICT specialists	Employed ICT specialists by gender (% of total)	Eurostat
ICT goods exports	ICT goods exports (% of total goods exports)	UNCTADstat database
ICT goods exports (USD)	ICT goods exports (in million USD)	UNCTADstat database
ICT services exports	ICT services exports (% of total services exports)	UNCTADstat database
ICT services exports (USD)	ICT services exports (BoP, current USD)	UNCTADstat database
Overall economic freedom	Overall economic freedom	Economic Freedom Index
Investment freedom score	Investment freedom	Economic Freedom Index
Public research and development (R&D)	Government budget allocations for ICT R&D (in million EUR)	2019 PREDICT project
Research and development (R&D)	Total domestic intramural expenditure on R&D, as a % of GDP [GERD]	Total domestic intramural expenditure on R&D, as a % of GDP [GERD]
Researchers R&D	Researchers in R&D (per million people)	World Bank
Education/human capital	Human capital index [pwt_hcl], years of schooling	University of Groningen, NL [pwt 9.1]
Education primary (government expenditure)	Expenditure on primary education (% of government expenditure on education)	World Bank
Services employment	Employment in services, by gender (in thousands)	ILOSTAT database

VARIABLES	DESCRIPTION	SOURCE
Trade openness	Trade in goods and services to GDP ratio [WDI]	World Bank
Duty tariff rate	Tariff rate, applied, weighted mean, all products (%)	World Bank
Income inequality	Gini Index	OECD
EU wages/salaries (by sector)	EU wages and salaries in the ICT services and manufacturing sectors (in million EUR)	Eurostat
Wages/salaries (by gender)	Wage and salaried workers, by gender (% of same gender employed) [SL.EMP.WORK.MA.ZS]	ILOSTAT database
Labour productivity	Labour productivity, ICT services and ICT manufacturing sectors (thousand EUR/person)	2019 PREDICT project
Macroeconomic indicators	World Economic Outlook Database (WEO)	International Monetary Fund

ARTICLE 7

DECENT OR NOT? THE SOCIO-ECONOMIC POSITION AND STATUS OF GLOBAL PLATFORM DIGITAL WORKERS FROM SERBIA

Branka Andjelkovic, Tanja Jakobi and Maja Kovac

This article interrogates the changing landscape of working conditions in the field of crowdwork on internet-based platforms while reflecting on the legal position and socio-economic status of digital workers from Serbia in the light of the ILO Decent Work Agenda. It draws on the findings of the first national study on the socio-economic position and legal status of digital workers from Serbia performed by the Public Policy Research Centre (hereinafter, the 'Centre'). The study deployed a mix-method approach, utilising the scraping of digital platforms, an online survey and semi-structured interviews, including content analysis of digital workers' open forums and scrutiny of legal and policy documents. While digital workers from Serbia mostly represent a group of highly educated workers with decent earnings, there are signs that they occupy a weak social and legal position stemming from inadequate legal solutions for this type of employment, including the unresolved status of online platforms as employers. The article thus provides an original contribution to academic and policy debate in the domain of the socio-economic position of platform workers from Serbia seen through the prism of decent work.

7.1 Introduction

Digital work is one of the first and most massive phenomena that links the fields of digitalisation, labour, and employment. Digital (crowd)work refers to paid remote work in which the employer is not necessarily located, or registered, in the same country as the worker. An analysis of the digital labour market shows that the supply side is more present in developing countries with a growing IT industry, while the demand is located in more advanced economies (OECD, 2018).

Serbia has been for years one of the world's primary suppliers of crowdworkers on internet-based platforms[1]. This 'silent revolution' (Aleksynska et al., 2018) was initially revealed in a 2015 World Bank report which ranked Serbia as one of the leading countries both globally and in Europe by the percentage of digital workforce in relation to the total population (1.1%) and the country's total workforce (2.6%) (Kuek et al., 2015).

Likewise, in December 2018, the Online Labour Index[2] of the Oxford Internet Institute placed Serbia eleventh in the world and fourth in Europe based on the size of its active digital workforce[3], while AnalyticsHelp (2018) listed Serbia as eleventh based on the proportion of its digital workers per capita (3.5%). In addition, Serbia was among the top 10 countries globally with regard to the continuous increase of the total earnings of digital workers (Payoneer, 2019).

The use of internet-based platforms has been growing rapidly in recent years, with their usage increasing by around 30–40% between 2015 and 2016 (OECD, 2018). The World Economic Forum in its latest report suggests that this sector of the economy is quickly expanding, with spending up 43% year on year in 2018 (WEF, 2020). Other sources point out that more than 30% of Fortune 500 companies use platforms to source their workforce (Chalendar et al., 2019).

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[1] In this article the terms internet-based platforms, digital platforms and online platforms are used as synonyms.

[2] For more details on the Online Labour Index, see Kässi and Lehdonvirta (2016).

[3] The latest data available before the release of the Center's study in January 2019.

This rise is attributed to the ability of platforms to efficiently and quickly match supply and demand, thus significantly reducing transaction costs (Manyika et al., 2015). The emergence of platforms has provided clients – individuals and legal entities – with an opportunity to achieve unprecedented scalability of the workforce. Platforms further offer a myriad of job opportunities, accessible even to those without previous work experience, which is particularly important for workers facing high barriers when entering the labour market due to their age, health conditions, or belonging to a particular vulnerable group (Greene and Mamic, 2015; Narula et al., 2011).

Moreover, platforms offer a huge concentration of digital workers with skills that cannot be found in regular labour markets (Chalendar et al., 2019), together with the possibility for their clients to establish and then terminate the (working) relationship as soon as the required task is completed (Marvit, 2014). In the recent past, this could not have been an option, even under the most flexible labour legislation. Lastly, by claiming that they are only intermediaries and not employers, the online platforms have been challenging the existing bilateral contractual relationship, thus taking national policy makers by surprise because labour legislation recognises only employers and employees in the context of their traditional roles and within national jurisdictions. However, such working practices may conflict with the ILO Decent Work Agenda principles that have been entrenched within local labour frameworks.

Relying on the findings of the first national study of the profiles and socio-economic status of the digital workers from Serbia (Andjelkovic et al., 2019), this article interrogates the changing landscape of the working conditions in the field of crowdwork[4] on internet-based platforms, and reflects on the legal position and socio-economic status of digital workers from Serbia with reference to the concept of the Decent Work Agenda (ILO, 2008a). In our research we understand the Decent Work Agenda as a multidimensional concept, within which the following relevant aspects of employment quality are fundamental: (1) income; (2) contracts

and security of employment; (3) access to social protection benefits; (4) work-life balance; (5) skills development; and (6) social dialogue. These dimensions have been selected based on their proven empirical relevance to the well-being of people in employment, and are treated as equally important and interrelated (UNECE, 2015).

However, this article particularly focuses on the first three dimensions, exploring them in more detail in relation to professions and skills and to non-standard forms of employment (NSFE) (ILO, 2016). In this regard, the article addresses the following questions: (1) what is the socio-economic and legal status of digital workers in Serbia from the perspective of the Decent Work Agenda; and (2) how does the current (labour) legislation impact upon the position and well-being of digital workers in the labour market? This article thus provides an original contribution to academic and policy discussions in the domain of the socio-economic position of digital platform workers from Serbia viewed through the prism of the Decent Work Agenda.

The article is organised in four further sections. Section 7.2 gives an overview of the methodology used in the Centre's study that this article is based on. Section 7.3 lays out the conceptual framework in discussing the status of digital workers from Serbia through the lens of the Decent Work Agenda and the challenges posed by the NSFE. Section 7.4 presents the main findings, while the fifth part places the survey results in broader context, draws conclusions and makes recommendations.

7.2 Methodology of the research

The study features a mix-method approach utilising the scraping of digital platforms, an online survey of a sample of digital workers from Serbia, semi-structured interviews with so-called *shapers* (digital workers, relevant policy makers, scholars, international gatekeepers), content analysis of digital workers' open forums, and the examination of primary legal and policy documents analysis. This pioneering research was conducted between January and December 2018. The collection of data was organised in line with the ethical principles for online research (Townsend and Wallace, 2016) and respecting the principles of data protection.

7.2.1 Research phases
The first research phase encompassed primary and secondary literature reviews and informal interviews with digital workers from Serbia. This phase provided both theoretical and practical insights into

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[4] The most commonly used classifications of paid work done on the internet are on-demand work and crowdwork (Sundararajan, 2016; De Stefano, 2016). In the case of on-demand work, the matching of supply and demand takes place over an internet-based platform but the service itself is delivered in a real, geographically defined space (e.g. Uber, Deliveroo). In crowdwork the entire process – matching supply and demand and service delivery – takes place online (e.g. Upwork, Freelancer) and the work is done remotely. The terms 'crowdwork' and 'digital work' are used interchangeably as synonyms in this article.

the features of the phenomenon of digital work. This research phase resulted in the identification of the most popular internet-based platforms among the crowdworkers from Serbia. It was conducted from January until March 2018.

The second phase involved the web scraping/ collection of open data[5] from the platforms that allowed the use of this method of information gathering. In this step we collected initial data on digital workers from Serbia, gaining a rough understanding of the demographics of this community, such as gender, along with the type of work they perform on the platform, their skills and biographies, client scores and comments, total income, and earnings over the preceding month.

The platforms were chosen based on the informal interviews, which showed that the most popular general platforms among digital workers from Serbia are Upwork and Freelancer. With regard to specialised platforms, Bibo Global ranked as the most sought after. The classification of general and specialised platforms was made in accordance with the range and type of tasks offered on platforms and the skills required. General online platforms are defined as those offering different types of work, while the specialised sites offer specific types of tasks such as foreign language lessons.

The third research phase involved an online survey aimed at obtaining information about digital workers from Serbia in relation to the Decent Work Agenda. The survey consisted of 36 questions grouped around six dimensions, namely: income; contract and security of employment; social protection benefits; working hours and work-life balance; skills development and training; and social dialogue. The survey recorded the views of a total of 227 respondents (120 men and 107 women) working on platforms such as Upwork, Freelancer, Bibo Global Opportunity, 99designs and ABC tutor. It was conducted in late July and August 2018.

The research also included an analysis of Facebook group discussions, which provided better insights into the challenges that digital workers face in their everyday work on the online platforms. The following four Facebook groups were analysed: Upwork (657 posts); Freelancers (54 posts); Bibo Global Opportunity (7 486 posts); and Microworkers (7 164 posts). This phase of the research was carried out in parallel with the online survey.

The fifth step of the research entailed 29 semi-structured interviews with digital workers (10 of whom were women), either face-to-face or via Skype, which allowed us to examine in depth the particular experiences and challenges faced by the workers in their platform work from the Decent Work Agenda perspective. The interviews were carried out in August and September 2018.

Finally, semi-structured interviews were conducted with decision makers in Serbia in order to assess current and future policy responses in the field and employment, tax regulation and social protection benefits. In total 10 interviews were carried out with representatives of the ILO Serbia office, the Serbian Ministry of Labour, non-governmental organisations, and trade unions active in Serbia. The interviews took place in December 2018.

7.2.2 Data analysis

The data obtained through web scraping and the online survey underwent preliminary triage before progressing to further analysis. Individuals who did not earn any income in the month in which platform data were collected were removed from the sample (having started from more than 16 000 open accounts, we reduced the final sample obtained through web scraping to 465 people, further referred to as 'active digital workers'). For the income analysis, to reduce dispersion and distribution bias we looked at a trimmed mean consisting of 90% of the sample. The frequency data were analysed using non-parametric Chi-square analysis (X^2). Analysis of variance (*F*-test) was used for factorial data that met the variance homogeneity condition, while the Mann-Whitney *U* test was employed for data that did not do so.

Unlike data obtained through web scraping and the survey, the datasets of interviews and the Facebook group analysis required qualitative processing. We deployed thematic analysis techniques that entailed three successive steps. An initial reading identified 'codes' (basic units of meaning), which were then grouped into larger units ('themes'). In the third step, the themes were compared through interviews (or groups, using transverse analysis).

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[5]   Web scraping is a term for various methods used to collect information from across the internet. Generally, this is done with a software that simulates human web surfing to collect specified bits of information from different websites. Web scraping is also called web data extraction, screen scraping or web harvesting. Web scraping is essentially a form of data mining. The practice of web scraping has attracted a lot of controversy because the terms of use for some websites do not allow certain kinds of data mining. Despite the legal challenges, web scraping promises to become a popular way of collecting information as these kinds of aggregated data resources become more powerful. For more information, see: www.techopedia.com/definition/5212/web-scraping

7.2.3 Limitations of the research

A few limitations affected this work. Although Upwork had been recognised as the most popular among the Serbian digital workers, the technical configuration of the platform did not allow for its data to be collected through web scraping. Due to this shortcoming, potential bias could have occurred in understanding the demographic characteristics of digital workers. Nonetheless, the survey, focus groups and Facebook forums corrected this limitation. Another weakness related to the classification of professions on the internet-based platforms. We applied the Oxford Internet Institute iLabour project division of professions into six groups. However, as pointed out by some of our respondents, the groupings were not segregated into clear categories, allowing for many overlaps and resulting in bias in choosing the primary profession. Despite this limitation, this categorisation allowed us to compare the participation of the digital workers from Serbia in the global digital labour market through an internationally recognised index.

Another challenge emerged in attempts to define active and non-active digital workers. We opted for the definition of an active worker as someone who registered his/her income on the platform in the last 30 days. The limitation here is that this is not a guarantee that he/she earned that money within this period, or, in other words, that the person worked in the given period. Last but not the least, a high percentage of survey respondents (17%) declined to reveal their legal status. During the interviews it was apparent that this information was hidden out of fear that it could be used by the tax authorities in Serbia.

7.3 Digital work in the context of the Decent Work Agenda

The ILO defines 'decent work' as 'productive work for women and men in conditions of freedom, equity, security and human dignity' (ILO, 2008b). Intrinsic to decent work is a fair income, contracts and social protection benefits for workers, security in the workplace, prospects for personal development and social integration, the freedom of workers to express their concerns and the opportunity to organise and participate in decisions that affect their lives. Accordingly, decent work represents a source of personal dignity, family stability and peace in the community, within democracies that deliver for people (ILO, 2008b).

The strategic importance of decent work benefits has been reflected in many national but also in supranational policies, such as the European Pillar of Social Rights (European Commission, 2017), OECD's Better Life Initiative (2014), and the UN 2030 Agenda.

7.3.1 Non-standard forms of employment (NSFE)

The means of communication and management, and the relationship between the employee and employer have been fundamentally shaken in the 21st century (Wallace, 2004). These changes, resulting from the development of a new economy, build on existing problems in the labour market, such as low employment rates, high youth unemployment, gender gaps in the labour market (World Bank, 2019), and increases in the number of people hired through NSFE (OECD, 2018).

The increase of NSFE – in terms of both volume and type – is one of the major challenges affecting the Decent Work Agenda. Non-standard work or non-standard forms of employment refer to different forms of 'new' work which have emerged in the recent past, such as: (1) temporary employment; (2) part-time and on-call work; (3) temporary agency work and other multiparty employment relationships; and (4) disguised employment and dependent self-employment (ILO, 2016; Eurofound, 2017). NSFE and work in the informal economy often overlap, so workers in NSFE are more frequently engaged in this sphere than workers in standard employment.

The common denominator for any type of non-standard form of employment is that it deviates from the 'standard employment relationship', that is, full-time, indefinite contracts and subordinate and bilateral employment relationships (ILO, 2016; Eurofound, 2017).

Different types of NSFE. In temporary employment, workers are hired for a specific period of time under fixed-term contracts, or have contracts based on a project or assignment, including seasonal or casual work, as well as day work. Looking further at this type of NSFE, temporary engagement through an agency and other intermediary (ILO, 2016; 2018) is the most common procedure. This arrangement implies that workers are not directly employed in the company where they provide their services but their employment is part of a multi-party contractual arrangement.

Part-time employment, as another type of NSFE, has been particularly increasing in recent years (ILO, 2016). It deploys specific legal thresholds that define part-time work versus full-time work, thereby separating part-time employment involving a restricted number of working hours from work that features off and on work patterns (on call). Thus, part-time work is usually considered as comprising of less than 35 hours, or 30 hours per week. In some cases, work arrangements may involve very short or unpredictable hours, so that the employer

is not obliged to limit himself to a certain number of hours when contracting. This work is governed by the various contractual forms available under specific legislation, most commonly called 'zero-hour contracts', and usually refers to 'on call work'.

The above characteristics of non-standard forms of work can also be observed in disguised employment and dependent self-employment (ILO, 2016; 2018). Disguised (hidden) employment involves a worker being employed as an 'independent contractor' and engaged through civil, commercial or cooperative contracts instead of by means of an employment contract, while the relationship with the employer takes the form of a classic employment hierarchy.

In conclusion, flexibility, but also economic and social insecurity are the basic common characteristics of NSFE. Non-standard workers are more exposed to precarious work, uncertainty about income and lack of the protection offered by standard employment. This has a significant effect in terms of the erosion of the principle of decent work, with legal, economic and social implications for individuals.

Digital work and NSFE. The digital economy, also often referred to as the 'gig' economy, encompasses non-standard forms of organising work and leisure ('gig' being a slang term for one-time work activity; Schmid-Drüner, 2016) and can be seen as part of a more comprehensive process of increasing flexible NSFE (Eurofound 2018; Avlijas 2019). The flexibility of work in the digital economy is reflected in the fact that workers, instead of having a working relationship with an employer, perform one-off tasks (or gigs) for which they are paid separately and without a guarantee of future employment (Friedman, 2014). Working in the gig economy is characterised by considerable flexibility in terms of working hours and it is up to the workers themselves to independently organise the time they spend doing the work (De Groen and Maselli, 2016).

Hence, digital work belongs to the sphere of NSFE, in particular to some of its variants: part-time work, disguised employment and dependent self-employment. However, a big difference is that there is no employer as understood in the traditional working relationship, defined as a bilateral relationship between employer and employee. Consequently, digital work has further contributed to reducing the rights inherent in decent work, embodied in the standard employment relationship, such as an eight-hour working day, social protection benefits, the right to paid sick leave, vacations and/or insurance in case of an injury at work, which are characteristics of decent employment.

7.3.2 Online platforms and the Decent Work Agenda

In claiming that their online apps function only as a kind of middleman between workers and clients, who seek out one another independently, online platforms define themselves as employment intermediaries (Todolí-Signes, 2017a). This enables them to opt out of the employers' role and shield themselves from the obligations they would have taken on had they been categorised as 'employers'.

By doing business online, such platforms operate outside of and beyond national boundaries, with no transaction costs, including the national insurance contributions of those who do work for them. Riding the wave of innovation, they have managed to gain a competitive advantage due to the absence, both nationally and globally, of legislation regulating their work, primarily labour and antitrust laws (Cherry and Aloisi, 2017). As a result, these platforms affect national labour markets worldwide, while remaining unrecognised and unregulated as employers in many countries. The development of digital labour has thus highlighted how outdated the notion of 'employer' is and has prompted a vigorous debate about the need for revising current definitions to better suit the aims of the Decent Work Agenda under new circumstances.

In the current debate revolving around the nature of platforms, a number of scholars (De Stefano, 2016; Berg, 2016; Aloisi, 2016; Prassl, 2018) argue that these platforms are actually employers, based on the multiple functions they perform. According to Prassl and Risak (2015), these functions are: setting rules for the performance of work; acting as economic profit-seeking entities; making decisions about hiring and termination; and paying and receiving remuneration for work.

We (Andjelkovic and Sapic, 2020) also introduced an additional element – data protection – to the functional definition of employer proposed by Prassl and Risak (2015). In this context, the EU's General Data Protection Regulation requires the employer to notify employees of how their data are kept and to appoint a data collector. Online platforms exercise this function as they have access to data and demand accurate and up-to-date information from workers at registration.

Regardless of these arguments, the internet platforms continue to operate in a void. Claiming an intermediary function, they only offer contracts for individual short-term gigs that include provisions governing fee payment, sanctions for non-performance and the venue for dispute resolution. As far as the platforms are concerned, digital

workers are self-employed and/or independent contractors, and their contracts lack any elements pertaining to labour rights or national insurance contributions.

National jurisdictions are unable to rise to this challenge, since the definitions that were formed under conditions of traditional (standard) work/employment were developed for national labour law arrangements, not for global phenomena such as crowdwork. Online platforms are unregistered in many jurisdictions, Serbia included, and as such are not subject to the rights and obligations prescribed by local legislation that are binding for traditional employers. Consequently, digital work results in an increasingly large number of workers being unable to access any type of labour contract or exercise the rights arising from such a contractual relationship[6].

7.4 Main findings and discussion

7.4.1 Key characteristics of the digital workers from Serbia

In this section we present findings from the domain of demographics in relation to Serbian platform workers, such as their age, education, professions and skills, previous working experience and the like. As indicated by both the web scraping and the survey, our respondents are young people, with the majority in the age cohort between 25 and 34 (Figure 7.1).

A total of 52.6% of respondents in our survey were men, indicating that men and women are equally represented on digital platforms. Even though this finding reveals that the genders are balanced in terms of being able to access digital work, as the subsequent sections will show, gender inequality exists in many aspects of platform work, from the shares of men and women in particular types of work to the rates they command for the same jobs.

Most digital workers surveyed come from urban centres (nearly half, or 47.4% of our respondents are based in Belgrade, the capital of Serbia), and no major differences between the genders are evident in this regard either.

Young and highly educated people make up the majority of crowdworkers in Serbia, as shown by

our survey (Figure 7.2). In most cases they have university degrees, in subjects such as economics, design, marketing, architecture, philology, engineering. In fact, more than two-thirds of all Serbian digital workers (75.8%) have at least tertiary education or above, while 24.2% of them have a secondary school or college diploma[7]. With regard to the education and gender distribution, women have higher education levels than men, more of whom enter platform work with only secondary education. In contrast, women working on digital platforms often have Masters and PhD degrees.

We classified the Serbian digital workers based on the six categories of professions established by the Oxford Internet Institute iLabour that encompass various sets of skills: software development and technology; creative and multimedia; writing and translation; sales and marketing support; clerical and data entry; and professional services[8]. Most of our survey respondents provide services in the fields of software and technology development (30%), writing and translation (29%) or in the creative and multimedia industries (22%). A significantly lower percentage of digital workers from Serbia are engaged in sales and marketing (3%), clerical and data entry (6%), and in professional services (10%).

Although formal education is a significant factor in the type of services platform workers provide, almost one-fifth of platform workers are engaged in service

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6   Serbian labour law defines different types of contracts (employment contract, service contract, casual work contract, or outside employment contract) as 'labour contracts'. Contracts of employment can be open ended or fixed term and allow workers to access a full range of rights within the framework of the employer–worker relationship.

7   Secondary education in Serbia lasts three or four years, depending on the type of school. There are general secondary schools (gymnasiums), vocational schools and art schools. The general secondary school offers four-year programmes which are focused on social and natural sciences and are equivalent to ISCED 3 level, while the secondary vocational school offers education programmes that last three (equivalent to ISCED 2 level secondary education) or four years (equivalent to ISCED 3 level secondary education). College (viša strukovna škola) lasts three years and is equivalent to ISCED levels 4 and 5. In Serbia, these colleges correspond to professional universities. See: https://eacea.ec.europa.eu/national-policies/eurydice/content/serbia_en and http://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-isced-2011-en.pdf (last accessed 27 April 2020).

8   The expanded versions of these six categories are: (1) software development and technology (data science, game and app development, software testing and quality assurance, software maintenance, software development, web development, web scraping); (2) creative and multimedia (architecture, audio production, logo and web design, photography, video production); (3) writing and translation (academic writing, article writing, copywriting, creative and technical writing, translation); (4) sales and marketing support (posting ads, lead generation, search engine optimisation, telemarketing); (5) clerical and data entry (data entry, transcription, technical support, internet searching, virtual assistants); and (6) professional services (accounting, consulting, legal services, human resources, project management).

Figure 7.1. Structure of platform work by gender and age
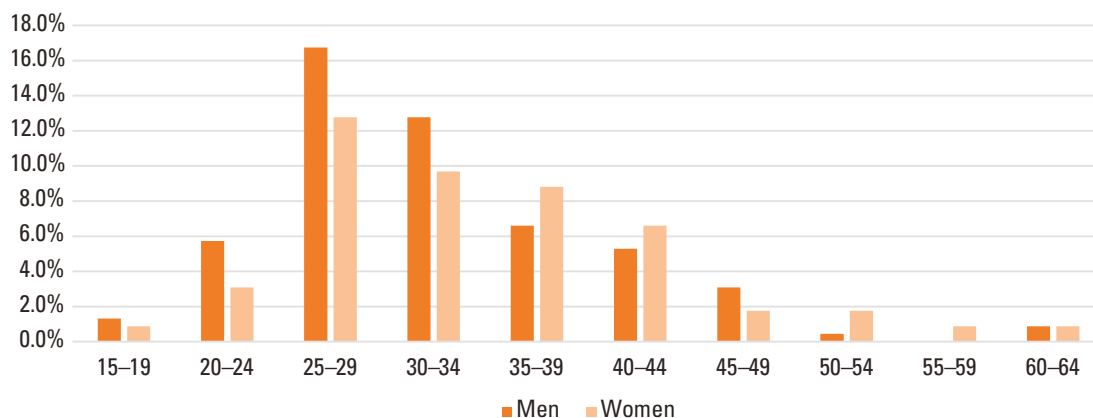
Source: Authors' calculation using the data from web scraping, the online survey and semi-structured interviews, as described in Section 7.2 (Methodology).

Figure 7.2. Structure of platform workers by educational attainment and gender
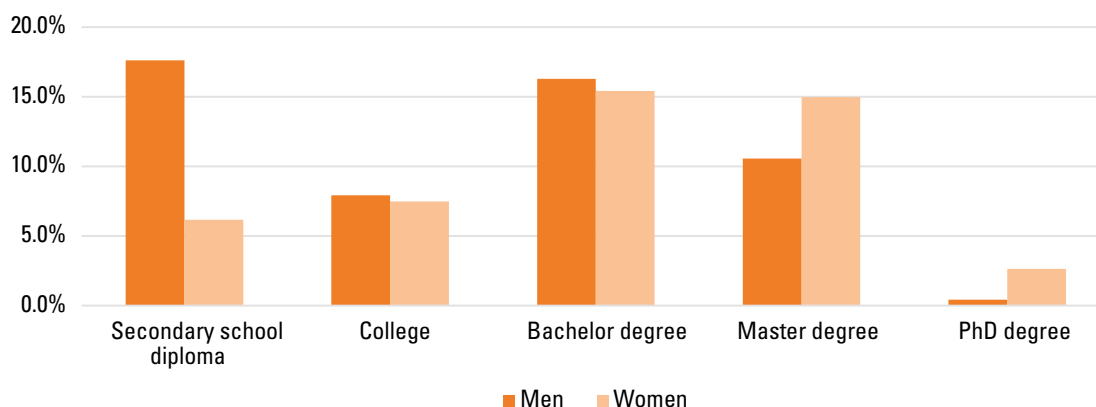
Source: Authors' calculation using the data from web scraping, the online survey and semi-structured interviews, as described in Section 7.2 (Methodology).

provision disconnected from their formal education background. For instance, 19.1% of those who completed studies in literature and foreign languages are engaged as 'IT workers' on the platform, while others who acquired their formal education in the natural and technical sciences provide services related to the social sciences (14.5%).

As for gender participation in the selected six professional domains, men account for 85% of the total number of IT workers (first category: software development and technology), while in the field of writing and translation women prevail with 67% (Figure 7.3). However, some balance can be seen in the skills offered in the field of creative industries, where men are slightly ahead compared to women.

Women dominate in the professional services, clerical services and data entry as well as sales and marketing. These data also reveal that men formally educated in the field of technical and similar sciences remain in these areas, while women (in most cases) regardless of their education dominate the field of social sciences.

Most digital workers work on general platforms that offer various types of work (e.g. Upwork and Freelancer), followed by those specialising only in one area such as foreign language lessons (Bibo Global Opportunity, ABC Tutor) or design (99designs). The testimonies from the interviews indicate that the workers predominantly work for clients in the United States, Australia, Japan and China.

Figure 7.3. Professions/skills and gender representation

Bar chart showing professions/skills and gender representation (Men, Women):
- IT sector: Men ~85.0, Women ~15.0
- Writing and translation: Men ~32.0, Women ~64.0
- Creative industries: Men ~39.0, Women ~33.5
- Sales and marketing: Men ~1.5, Women ~9.0
- Clerical and data entry: Men ~6.0, Women ~15.0
- Professional services: Men ~11.5, Women ~20.5

■ Men ■ Women

Source: Authors' calculation using the data from web scraping, the online survey and semi-structured interviews, as described in Section 7.2 (Methodology).

There is no statistically significant difference between the surveyed men and women in terms of their previous working experience. Almost half of the men and women (45%) were employed in the offline world and were taking a step towards additional engagement in the digital domain, while 6.6% of them were entrepreneurs before starting work on digital platforms. Almost half of the women and every third man did not have a job or were in school or college before working on the platform.

7.4.2 Income in digital work

In this section we focus on online work in the context of NSFE and discuss the position of crowdworkers from the perspective of income and work-life balance. We also highlight the impact of the professions and skills on digital workers' earnings, as well as their motivation to work on online platforms. The gender dimension is also assessed through the focus on income.

In general, digital workers from Serbia earn well compared to workers engaged in other types of NSFE in the country. The average gross income of our survey respondents is approximately USD 1 200 per month[9]. The average gross monthly income for men is USD 1 450, while women earn approximately USD 930. Half of all men in our

sample earn more than USD 1 000 per month gross, while half of all women surveyed earn less than USD 600; this is the median income distribution for women and men in our study[10]. Interestingly, women with Masters and PhD degrees earn less than men with a secondary school diploma.

The most profitable professions belong to the IT, creative industries and sales and marketing domains. On average, professionals in IT (men and women) earn on average USD 1 450, in the creative industries USD 1 350, and in sales and marketing USD 1 375 gross per month. In contrast, those in other professions earn considerably less – on average USD 885 gross per month (see Figure 7.4).

In the sectors that traditionally pay less and conceived as 'women's work', such as writing and translation, women constitute 41% of the workforce. In all professions, except in the field of writing and translation, women earn less than men. For example, in the most profitable IT sector, men earn on average USD 1 790 gross per month, while women earn USD 1 100.

According to our survey, the key motivating factors for being engaged on the digital platforms are the possibilities for earning extra money (27.6%) and gaining access to better-paid jobs (17.1%), as well as the lack of prospects in terms of finding offline work (as reported by 12.3% of the surveyed sample) (see

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[9]   Gross income comprises the overall earnings of a platform worker, before any deductions for platform fees, money transfer fees or different types of social benefits insurance.

[10]   Men earn more than women irrespective of the work they do (F = 8.978; p = .003).

Figure 7.4. Gender, professions/skills and earnings
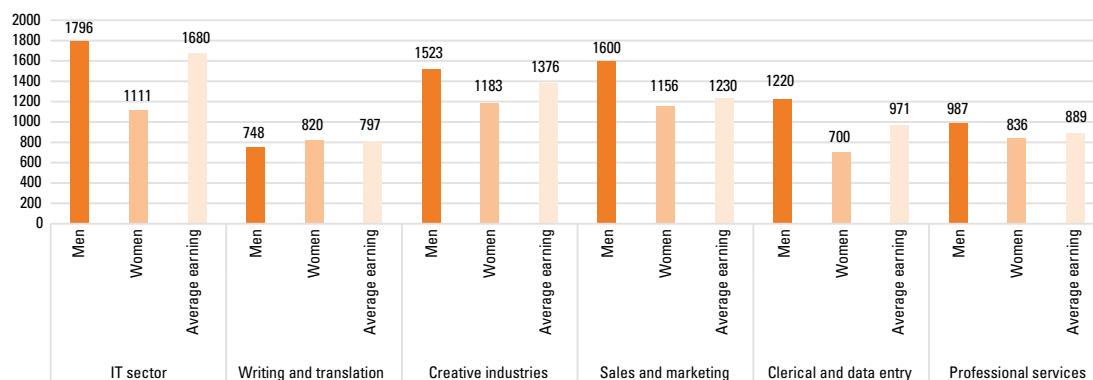
Bar chart showing earnings by gender and average earning across six sectors:

IT sector: Men 1796, Women 1111, Average earning 1680
Writing and translation: Men 748, Women 820, Average earning 797
Creative industries: Men 1523, Women 1183, Average earning 1376
Sales and marketing: Men 1600, Women 1156, Average earning 1230
Clerical and data entry: Men 1220, Women 700, Average earning 971
Professional services: Men 987, Women 836, Average earning 889

Source: Authors' calculation using the data from web scraping, the online survey and semi-structured interviews, as described in Section 7.2 (Methodology).

Figure 7.5). A comprehensive analysis of the findings obtained from the online survey and semi-structured interviews shows that the key motivation for both men and women supporting their engagement on the digital platforms relate to flexible ways of working, decent income or earning extra money.

Moreover, narratives from the field indicate that working on digital platforms enables both overcoming barriers to entering the labour market and investing in developing new or existing skills, as well as utilising skills for which there is no demand locally in Serbia. For our respondents, working on platforms represents a way of achieving a more dignified working environment, this being especially emphasised by the female interviewees.

While the primary motivation for both women and men are the same – to earn extra money – they differ in other focal aspects. Namely, women are usually engaged on the digital platforms as a consequence of their inability to find a job in the offline environment.

As our survey shows, both men and women usually spend fewer than 40 hours a week in digital platform work (Figure 7.6). The minority working longer hours (6.1%) are men who are at the same time entrepreneurs or company owners. They also belong to the cohort of those who earn the most.

In our sample, digital workers are almost equally divided between those whose work on platforms is

Figure 7.5. Motivation for working on online platforms
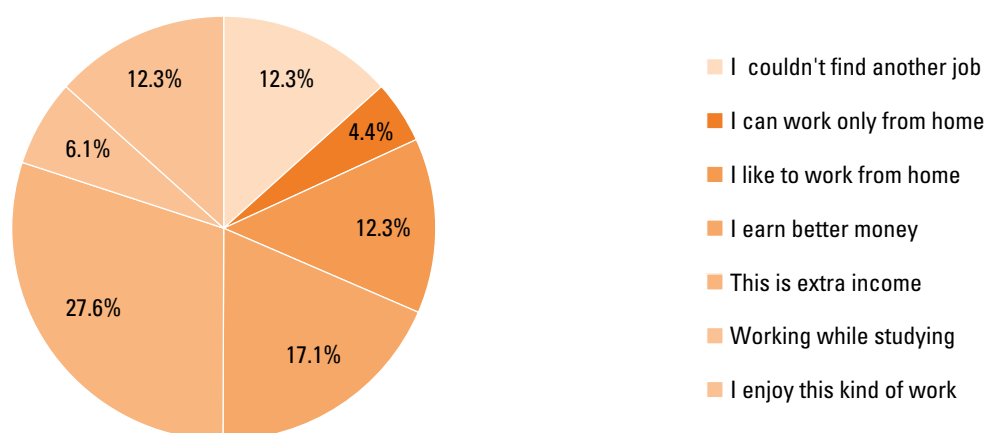
Pie chart with segments:
- 12.3% I couldn't find another job
- 4.4% I can work only from home
- 12.3% I like to work from home
- 17.1% I earn better money
- 27.6% This is extra income
- 6.1% Working while studying
- 12.3% I enjoy this kind of work

Legend:
- I couldn't find another job
- I can work only from home
- I like to work from home
- I earn better money
- This is extra income
- Working while studying
- I enjoy this kind of work

Source: Authors' calculation using the data from web scraping, the online survey and semi-structured interviews, as described in Section 7.2 (Methodology).

Figure 7.6. Working hours on online platforms
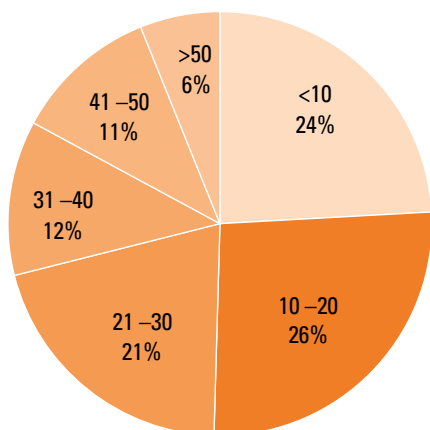
> *Source:* Authors' calculation using the data from web scraping, the online survey and semi-structured interviews, as described in Section 7.2 (Methodology).
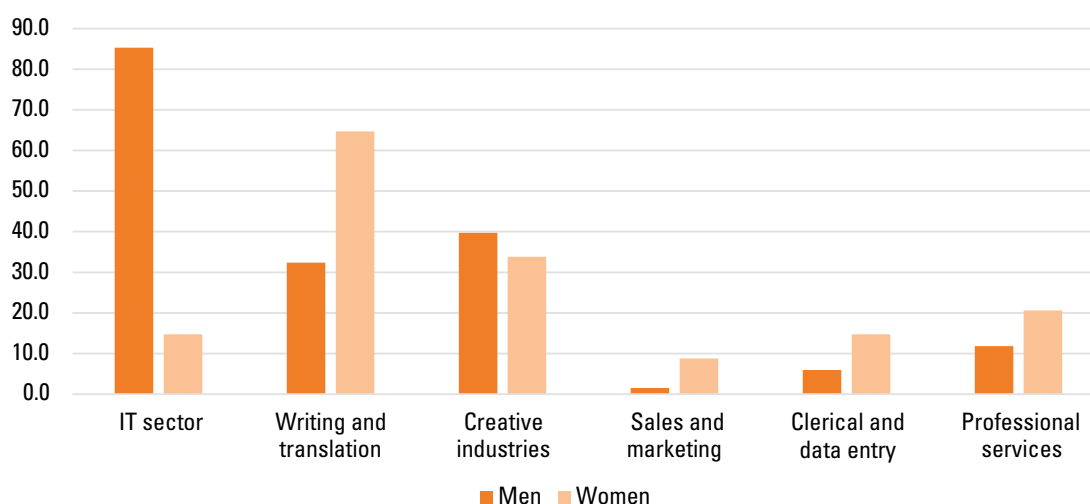
their main job (37%) and those for whom it is a side activity (46%). The remaining respondents (17%) did not provide an answer to this question. The findings also reveal that most digital workers who work more than 20 hours per week have no other job, meaning that digital work is their sole source of income.

In the majority of cases digital workers (particularly men) fare better than their peers in NSFE offline environment. On average, salaries and wages in temporary or occasional employment in August 2018 in Serbia were USD 460 gross per month, or USD 324 net[11], compared to USD 1 200 gross per month for all digital workers. On the other hand, the average gross salary in the Serbian labour market was USD 680 (Statistical Office of the Republic of Serbia, 2018). The average consumer basket as a measure of living standards in Serbia in the same month amounted to about USD 700 (Ministry of Trade, Tourism and Telecommunications, 2018).

In conclusion, digital workers enjoy a favourable socio-economic position as a result of their education and marketable skills in terms of the digital economy. Income is one of the main motives for workers from Serbia joining the digital workforce and is a primary driver fuelling their online engagement. The Centre's findings coincide with the findings of similar studies conducted in countries with the same or similar level of development as Serbia, such as Ukraine, Russia, Bulgaria or the Philippines (Shevchuk and Strebkov, 2015; Meil and Kirov, 2017; Graham et al., 2017; Aleksynska et al., 2018).

Short-term digital work produces positive impacts on individuals and national economies by enabling workers to attain a decent standard of living. The data presented above confirm these findings: the earnings of digital workers compared to those in full employment and in NSFE in Serbia are on average higher. However, the structural characteristics of digital work, reflected in income and gender inequalities, call into question its long-term benefits, both for the individual and for society, thus challenging the concept of decent work. As we will see in the next section, this is further demonstrated when the issue of the contractual relationship is included in the equation.

7.4.3 Work contracts and employment security

In this section we discuss the types of contracts available to digital workers in Serbia and compare them to the legal status of other non-standard forms of employment. We also explore the professions of crowdworkers in relation to their legal incorporation and assess the impact on their income. Furthermore, we discuss the interconnectedness between legal status and the time spent on platforms, as well as the gender dimension.

As highlighted through the semi-structured interviews, digital work is not recognised in the Serbian labour legislation, so the only option available is the registration of a business entity. This can be done by registering sole entrepreneurship, which is equivalent to the status of 'sole proprietor' or self-employment in many other national jurisdictions[12], or through the registration of a company. Almost a third of the surveyed digital workers (31%) regularised their legal status by registering as a sole proprietor/self-employed or as a company owner. Of those who registered their business entity, the majority were sole proprietors, while only a few established companies (Figure 7.7). Most digital entrepreneurs (who registered their business entity) were men (40%), whereas only 18% were women.

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11 Statistical release: Average salaries and wages per employee, August 2018, Salaries and wages statistics, Statistical Office of the Republic of Serbia.

12 Entrepreneur or 'sole proprietor' is used to define a business entity owned and managed by one individual. The owner, called the sole proprietor, thus does not pay separate tax income on the company, but reports all loses and profits on his/her individual tax return. Because the owner is indistinguishable from the business, he/she remains personally liable for all the debts of the business. By contrast, 'business entity' is a type of business organisation that offers the limited liability of a corporation (LLC) and the tax benefits of a partnership. The owners of a LLC are referred to as 'members', whose rights and responsibilities in managing the LLC are governed by an operating agreement. See: www.law.cornell.edu/wex/Limited_liability (last accessed 28 April 2020).

Figure 7.7. Registration status and disguised employment

Status in employment				
Registered		**Disguised employment**		
Entrepreneurs/ sole proprietors self-employed	Company owners	Employed who work extra hours on platforms	Unemployed	Inactive population
29%	2%	23%	19%	27%

Source: Authors' calculation using the data from the online survey and semi-structured interviews, as described in Section 7.2 (Methodology).

Those who have not regularised their status in this way remain in disguised employment. Namely, some online workers have jobs in the offline world, with digital work serving as an extra income stream (23%). However, they are not able to register their extra engagement as platforms are not recognised as employers under Serbian legislation, which is a precondition for a contractual relationship to be established. Extra work of up to 20 hours per week is acceptable, but in order to register it, the employer has to be documented in the local jurisdiction.

Other digital workers who remain in disguised employment are those who are registered as unemployed with the National Employment Agency (19%) or those considered part of the inactive population (27%). The possibility of registering as an independent worker and/or a freelancer[13] is not viable in practice in Serbia, although there is legal basis for having recourse to such a solution. Currently, it is only available to a limited number of professions (e.g. artists, journalists, priests). Even if this solution were available, for these digital workers formal registration is not an option due to the volatility and instability of their income.

According to our survey, across the three most prevalent professions among digital workers in Serbia legal status varies. The share of those who are registered as entrepreneurs (sole proprietors) is the largest for the respondents who work in the field of information technology and have a related educational background (15%). Among those who work in writing and translation only 4% opted to register as an entrepreneur or company owner, while in the creative industry and multimedia fields 6.2% decided to take this route.

In other words, our survey respondents with IT skills and a relevant education are more likely to find themselves in a regulated business environment and have contracts. Those who have a background in micro-tasking and other services often find themselves either registered as unemployed or considered part of the inactive population. Therefore, it is not surprising that from the perspective of legal status and income, the best earners are the digital workers who registered as company owners and/or sole entrepreneurs, followed by those who work on platforms in addition to their main job (Figure 7.8).

When assessing the relationship between legal status and gender, women are less prone to registering as entrepreneurs then men. As noted in the interviews, in many cases men opt for this kind of status regularisation because they are required to do so by their business partners abroad. Women, on the other hand, value highly the social protection benefits attached to standard employment, and therefore choose online work as an extra engagement that complements their income.

Although some digital workers embraced solutions provided by the Serbian legal framework and decided to register as an entrepreneur/sole proprietor or a company, most of them remain in disguised employment, thus contributing to the rise of NSFE, which are already relatively high in Serbia – at the time of our research, in the third quarter of 2018, NSFE accounted for 20.4% of total

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[13] Freelance employees, also known as 'independent contractors', are individuals who work on their own, without a long-term contractual commitment to any employer. A freelancer usually performs services or completes work assignments under short-term contracts with several employers, or clients, who have the right to control only the final result of the individual's work, rather than the specific means used to accomplish the task. Examples of positions held by independent contractors range from doctors and computer programmers to maids and farm workers. At present, academic researchers typically use the term freelance to refer to own-account workers in various professions (see Kazi et al., 2014).

Figure 7.8. Legal status and earnings
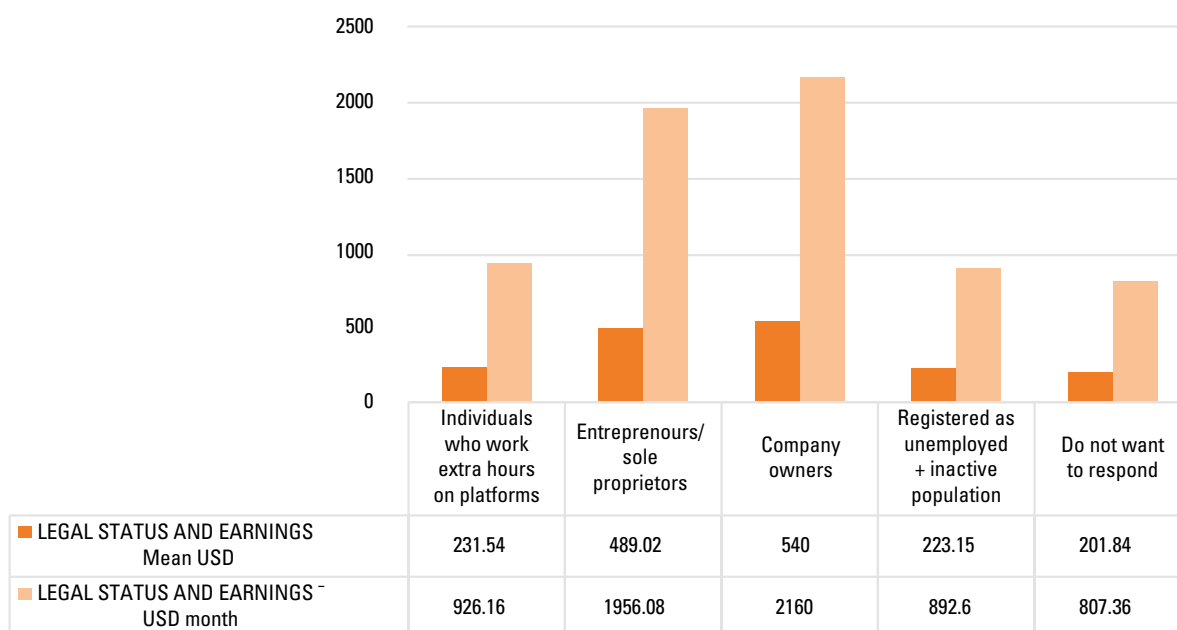
	Individuals who work extra hours on platforms	Entreprenours/ sole proprietors	Company owners	Registered as unemployed + inactive population	Do not want to respond
■ LEGAL STATUS AND EARNINGS Mean USD	231.54	489.02	540	223.15	201.84
■ LEGAL STATUS AND EARNINGS ‾ USD month	926.16	1956.08	2160	892.6	807.36

Source: Authors' calculation using the data from the online survey and semi-structured interviews, as described in Section 7.2 (Methodology).

employment in the country (Statistical Office of the Republic of Serbia, 2018).

As explained, Serbian digital workers are in a less favourable position than their European counterparts who can register as freelancers and/or independent workers. This option, which both curtails the informal economy and reveals hitherto invisible workers, such as those who work online, is available in Germany, Sweden, Spain, the Netherlands, France, Belgium, Latvia and Estonia (Jasarevic and Bozicic, 2020)[14]. Belgium also recognises freelancing as an option to earn additional income for those who are formally employed and allows registration as an 'independent worker' (indépendant complémentaire) (ibid.)[15].

Although these legal solutions contribute to the better position of digital workers, they do not allow the enjoyment of the benefits of full-time employment and/or open-ended employment. The major reason for this is that platforms are not considered or registered as employers in most national jurisdictions, including Serbia, as discussed in Section 7.3 of this article. Since there is no

employer in the traditional sense of a contractual relationship, all social security costs are transferred to workers who cannot establish employment or conclude contracts as the basis for exercising their fundamental labour and employment rights.

7.4.4 Access to social protection benefits

In this section we discuss access to social protection benefits from the NSFE perspective and with regard to the professions/skills and gender dimensions. More than half of the surveyed digital workers (around 54%) gain access to social protection benefits either by having another job or through establishing the status of entrepreneur (sole proprietor or company) (Figure 7.9). In this way, they enjoy the entire social protection benefits package – healthcare, pension, insurance in case of disability, and unemployment insurance. As women more often have another (offline) job while men are more often entrepreneurs, no gender disparities were spotted in terms of access to the basic social protection system.

For the remainder of the respondents, the issue of access to social protection benefits is considerably more tangled (see Figure 7.9). Their short-term contracts with platforms do not recognise any of these rights. At the same time, as already mentioned, the local legislator does not recognise them as freelancers and/or independent workers. Therefore, those who work under the radar cannot enjoy such benefits as the state pension, disability

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14 To be eligible, freelancers must meet several criteria, such as belonging to certain professions and a maximum total income over the course of the fiscal year.

15 This group is taxed on their total income (both their earnings from regular employment and their freelance income) and must also pay national insurance contributions.

Figure 7.9. Access to social protection benefits
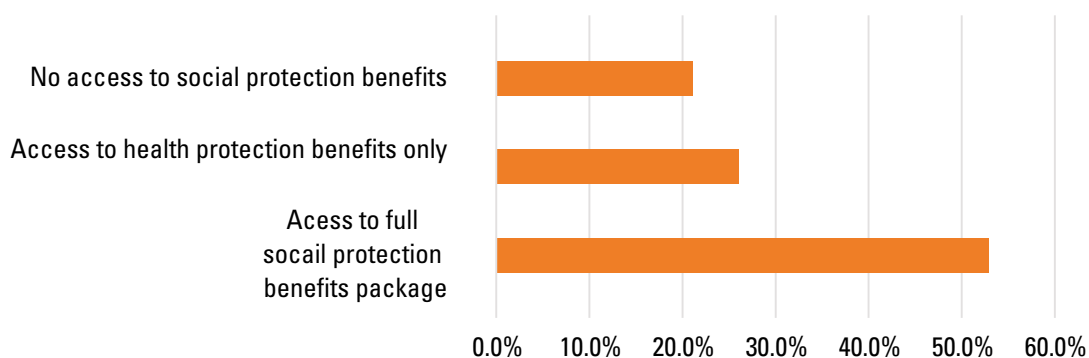
No access to social protection benefits

Access to health protection benefits only

Acess to full socail protection benefits package

0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0%

Source: Authors' calculation using the data from the online survey and semi-structured interviews, as described in Section 7.2 (Methodology).

insurance, unemployment insurance coverage, etc. The only option for them is to access these rights through private insurance funds.

One exception to this is access to healthcare. Due to the universal nature of the healthcare system in Serbia, most of the citizens in Serbia are insured – 97.2% (SIPRU, 2018). This also includes (digital) workers who are officially registered as unemployed at the National Employment Agency or have insurance through their parents (if younger than 26) or their spouses. However, surprisingly high number of digital workers in our sample (20.09%) report that they do not have access to healthcare.

Around half of the surveyed crowdworkers from the three most dominant professions in Serbia generally have full access to social protection benefits (Figure 7.10): the IT sector (63.2%), the creative industry and multimedia fields (51%), followed by

those active in writing and translation (41.5%). The high percentage of those covered by the social protection benefits in the other three professions should be viewed with caution, given their small size in our sample.

The majority of the respondents (66%) do not save for the future, and in this respect there are no differences between the genders. It is interesting to note that both crowdworkers who have access to social protection benefits and those who do not equally opt for private insurance plans. Most sought after is private health insurance (16.4%) while life insurance and retirement plans are less popular.

To conclude, access to social protection benefits for digital workers in Serbia is strongly interrelated with their legal status. Online workers earn more than those in other non-standard forms of

Figure 7.10. Professions and access to social protection benefits
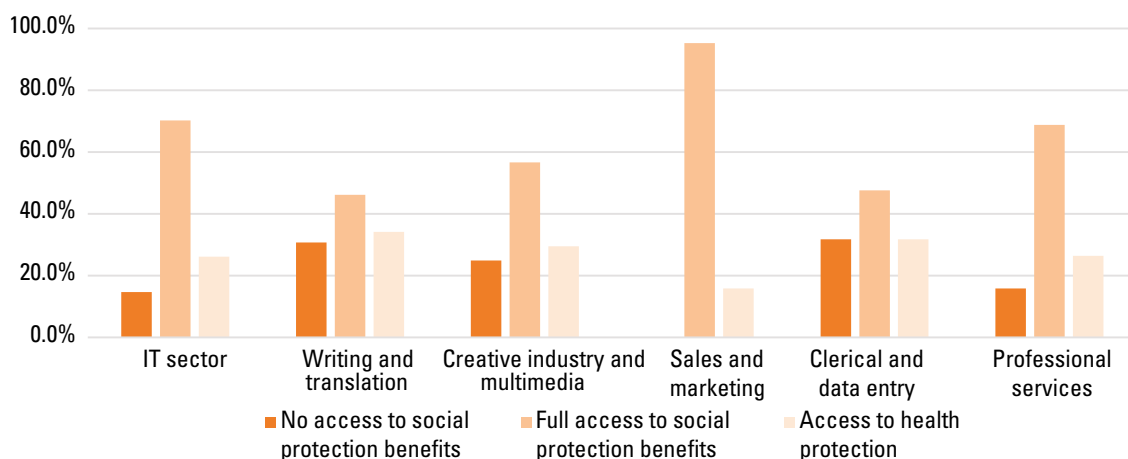
| | No access to social protection benefits | Full access to social protection benefits | Access to health protection |

Source: Authors' calculation using the data from the online survey and semi-structured interviews, as described in Section 7.2 (Methodology).

employment and this allows them to access private insurance plans if they want to (retirement, health or life insurance). Given that the Serbian health insurance system is universal, the least difference between digital workers, those in NSFE and the full-time employed is seen in the domain of health protection.

The position of Serbian crowdworkers mirrors that of their colleagues in Europe and elsewhere (Pesole et al., 2018; Berg et al., 2018; Aleksynska et al., 2018), since legal regulation is lagging behind in accommodating these new trends, characterised by non-linear careers, which are in contrast to the current design of the social protection benefits system in Serbia and elsewhere. However, some countries, such as the Nordic countries, Belgium, France, Malta and Portugal, have already responded to this challenge by adapting their social protection systems to address the absence of an employer by shifting the share of the burden between the digital workers and the state (Jašarević and Bozicic, 2020; Fulton, 2018).

These measures represent the response of the state to a situation in which the status of platforms as employers is still unresolved. However, these solutions do not fully answer the problem of digital workers, who in general lack access to many of the social protection benefits which are a fundamental part of decent work.

7.5 Conclusion

Digital work as a new type of non-standard employment introduces novel elements into this domain, which is typically populated by workers with lower levels of education, engaged in simpler, usually manual tasks which are also less well paid. Due to their higher level of education and relatively high earnings, digital workers from Serbia are often seen as enjoying a standard of living which is above or on a par with full-time employees, and far better than those in other non-standard forms of employment. Indeed, access to global markets, the ability to transcend the limitations of the local labour market, and the possibility of advancing their skills, give them an aura of 'exclusivity'. Not surprisingly, the results of our research show that the majority of digital workers are very satisfied with their work.

However, and what cannot be seen at a first glance, pay inequality within this workforce in Serbia is very high. According to the research results, the total earnings of the top 20% of digital workers are 18 times higher than the earnings of the bottom 20%. In comparison with the traditional economy, these differences are twice as large

as those between workers' salaries in the offline world; there the total income of the top 20% of the population in Serbia is 9.7 times higher than the income of the bottom 20% (Krek, 2018), although the two spheres of work cannot be fully compared.

The ambiguous nature of platforms and outdated national regulations have contributed to the fragile socio-economic position of digital workers. Disguised employment and dependent self-employment are key features of this new non-standard form of employment in the case of Serbia. Those without contracts are not covered by the provisions of labour law or employment-based social protection benefits. As explained, platforms do not incur costs such as social security contributions, sick pay, maternity benefits and statutory minimum wages. On the other side, the local regulator does not recognise any legal option apart from registering as a business entity. In the absence of other legal solutions, most digital workers, especially women and those in lower skilled categories, are prevented from enjoying the benefits of decent work, particularly with regard to accessing social protection benefits. Consequently, when asked about future choices, the majority of digital workers still prefer to work in the traditional economy with a full-time employment contract, with their work on platforms considered as a significant complementary activity. Only 20% of surveyed respondents choose to work on platforms as their only job.

In sum, from the analysis of the three aspects of decent work considered in this article (income, work contracts and social protection), digital work seems to be a satisfactory choice from the income point of view. As demonstrated, a significant minority of highly educated people earn more than the average wages provided in the traditional economy, despite the observed greater level of pay inequality. On the other hand, digital workers in Serbia are less likely to enjoy the employment-related benefits which are included in standard work contracts. This is mainly because digital work did not exist when the labour legislation was adopted, so the situation of these workers has not been taken into account in the 'traditional' employer-employee relationship in Serbia, as well as in many other countries.

At the same time, it is important to emphasise another finding of the article. By disclosing the capacity of crowdworkers in terms of their knowledge and skills, the research also showed that Serbia boasts a considerable level of human capital. The country's digital workers are capable of competing in a global labour market and are vital to the development of the knowledge-based

economy at home. As the responses of the digital workers show, there is a shortage of high-quality 'decent' jobs available in Serbia, so a significant number of them choose this type of work in the absence of other 'decent' options. Thus, the new jobs created through digital platforms ('jobs without borders') provide a livelihood for a significant minority of people who are faced with a lack of high-quality traditional jobs in Serbia. As a result, one can even claim that these online jobs are preventing the emigration of some highly skilled people from the country, leading to a reduction in the 'brain drain'.

If Serbia wants to keep this highly educated workforce with marketable skills at home it has to address the current void in international labour regimes by comprehensively and systematically regulating the legal status of digital workers. This can be done by overhauling fundamental definitions and introducing new provisions into the national Labour Law in line with the changes already present in the European legal framework, thus creating more flexible definitions of 'employment', 'employee' and 'employer'. In this new regime, 'worker' would be defined as any person who earns income from his/her work regardless of the legal basis, for example type of contract or even the lack of it. It should replace the term 'employee', which in the current labour regime covers only workers in a standard employment relationship. As

for the 'employer', the definition should be based on the functions of a business rather than on the contractual relationship with the (digital) workers. To reflect these amendments, complementary changes also ought to be made in the social protection system to allow digital workers access to social protection benefits. Such a systemic approach would also permit the unambiguous tax treatment of digital work, which would, ultimately, ensure that this activity is moved out of the domain of disguised employment and accorded formal status.

However, this change would form only a partial solution. If online platforms were recognised and defined as employers within an international legal regime that governed labour it would be far easier to develop national frameworks that would allow workers to work locally in their home country for employers not registered in the same jurisdiction. Treating platforms in the same way as other multinational corporations would allow digital workers to benefit from various types of social protection measures.

If the platforms as legal entities continue to be unregulated by international labour rules, this will further undermine the principles of the Decent Work Agenda, by placing the burden of attaining the benefits of decent work on workers' shoulders, and, partly, on national governments, if they are willing to bear it.

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ARTICLE 8
NEW EMPLOYMENT PATTERNS IN PLATFORM-BASED RIDE-HAILING SERVICES IN SERBIA: A CASE STUDY OF CAR:GO DRIVERS

Jelena Starcevic

This article focuses on the employment patterns of Car:Go, a Serbian platform-based start-up providing ride-hailing services. With little data available on this type of platform work, it closely examines the characteristics of this ride-hailing business and its drivers. The research aims to understand whether ride-hailing platforms are creating new employment patterns and contributing to the growth or decline of the informal economy. The research employed an explanatory mixed methods design, using an online survey and in-depth interviews with drivers to gain a more comprehensive understanding of the Car:Go phenomenon. The findings include a description of the Car:Go business model, as well as an analysis of the characteristics of Car:Go drivers, and the employment patterns created by Car:Go. Furthermore, the article compares its findings with those of studies on the platform economy and platform work carried out in other parts of Europe and the world, as well as with the general working population of Serbia. The purpose of the article is to contribute to the body of research on the future of labour and the effects of digitalisation on labour markets.

8.1 Introduction

Today's complex global economy is driven by new technologies and digitalisation, which allow for traditional transactions to be made more efficiently, on a larger scale, and with lower transactional costs. Digitalisation is allowing new business models to emerge, such as the platform economy, which enables its users to 'share, lend, rent or purchase goods and services' (Kilhoffer et al., 2017, p. 16). The rise of the platform economy can also be attributed to its ability to adjust quickly to market fluctuations and reduce the costs of labour (De Stefano and Aloisi, 2018).

The platform economy is growing rapidly and significantly, and in many different distinctive types. While the use of technology is a common feature, there are significant differences among the types of platform work available. In the literature, a wide range of definitions and models can be found, but two main distinctions are made between 'on

demand via app work'[1] and 'crowdwork'[2]. Platforms are usually described as acting as intermediaries between those requesting a service and those providing one (De Stefano and Aloisi, 2018). Within the European framework, the platform economy is defined as a 'business model where activities are facilitated by collaborative platforms that create an open marketplace for the temporary usage of goods or services often provided by private individuals' (European Commission, 2016, p. 3).

Working in the platform economy has both positive and negative effects. Kenney and Zysman (2016)

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[1] On demand via app work is typically a low- to medium-skilled form of work that relates to typical working activities (transportation, cleaning, running errands) demanded via a mobile application but carried out physically and locally.

[2] Crowdwork refers to working activities that can be low skill (click work, data entry, tagging) or high skill (design, programming, translation) and which are entirely performed online and remotely via an internet-based marketplace or platform.

posit that, while labour markets may become more efficient through the use of the platform economy, this type of economy may increase the levels of part-time employment without social benefits. For some, the flexibility the platform economy affords is seen as a positive attribute, while others point out that the platform economy is providing less reliable work with fewer benefits (Sundararajan, 2016). Some reported practices found in the platform economy that may negatively affect workers include:

- workers being prevented from appearing on competing platforms;
- workers not paid a minimum wage;
- not considering the workers as such and therefore limiting their rights;
- not allowing workers to form or join trade unions in order to defend their interests (Fabo et al., 2017).

Acknowledging that the platform economy may pose the risk of creating a labour market with poor labour rights, the European Commission urged national authorities to 'recognise the specificities of the labour platforms without sacrificing the type of protection afforded to those who have the status of employee' (Fabo et al., 2017, p. 170). However, theorists and legislators struggle to define one uniform regulatory framework appropriate for the platform economy and its workers. Another major difficulty for policy makers lies in the fact that platforms enter markets without consultation, or even despite being prohibited. A practical legitimacy is constructed through users' endorsements (Frenken and Schor, 2019).

Ride-hailing is one of the best-known industries emerging as part of the platform economy. It is currently present in over 170 countries. Ride-hailing services connect the driver of a vehicle with a user through an application or a website (Marciano, 2016). Ride-hailing has become so popular that work in this sector has even received a new designation – Uberisation. The most prominent feature of Uber, along with most of the other ride-hailing services, is that it has lowered the high barriers to entering the passenger transportation market for a number of people through posing as an information business rather than a transportation company. The other defining characteristic of ride-hailing business models is that drivers are categorised as 'independent workers'. With the increasing market penetration of ride-hailing companies such as Uber, Lyft and Didi, the precarious position of this category of workers has attracted the attention of academics and legislators alike.

The Republic of Serbia (hereafter Serbia) has also followed the global trend in digitalisation and the rise of work in the platform economy. Working eight hours in a day for one employer is no longer necessarily the norm for Serbian workers. The country is seeing a replication of the trend of other European countries and the United States, where some 25–30% of the working population are part of the independent workforce (McKinsey Global Institute, 2016). Serbia is among the top five countries for the proportion of its population engaged in digital work[3] (Kuek, 2015). Research conducted by the Public Policy Research Centre shows that, typically, digital workers in Serbia are in their twenties, are university level educated, and live in urban areas. Two-thirds operate in the informal economy sector, while 29% are self-employed – a choice made out of the necessity to regulate their online work, rather than in pursuit of genuine entrepreneurial ambitions (Andjelkovic et al., 2019). However, the platform economy in Serbia is not limited to digital workers. There are platforms offering transportation, delivery services, household repairs, cleaning or dog-walking.

In 2015, Serbia joined the ride-hailing service sector with its own start-up, Car:Go. Despite its modest initial beginning, Car:Go presents one of the most rapidly expanding platforms, having currently over 1 000 drivers. As with other ride-hailing services, Car:Go has been the subject of much debate over the legality of its operation and the working conditions of its drivers. According to the available literature, the status, labour conditions and social protection of digital workers (those working in crowdwork) are different from those of app-based workers who carry out their work locally. As there is scant information in Serbia about this second group of platform workers, this research attempted to fill that void by looking at the ride-hailing sector.

The aim of the research was to understand the characteristics of ride-hailing platforms and platform drivers in Serbia, and whether the ridesharing platforms create new employment patterns and contribute to an increase or a decrease in the informal economy. The purpose of the study is to contribute to the body of research regarding the future of labour and the effects of digitalisation on labour markets.

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[3] Those working in crowdwork.

8.2 Methodology of the research

The research aimed to answer two questions: (1) how is Car:Go changing employment patterns in Serbia; and (2) does Car:Go generate new forms of informal employment or contribute to the increase of formal employment? The investigation answered the research questions using a mixed-methods approach. The research design combined quantitative and qualitative methods for the collection, analysis, interpretation and reporting of the data, using an explanatory design. The objective of using mixed methods was to incorporate the strengths of both approaches, as it provided a more comprehensive understanding of the Car:Go phenomenon.

As seen in Table 8.1, the data collection and analysis was carried out in three phases.

The first phase consisted of the identification and review of existing documents, including government policies, newspapers, the Car:Go website and journal articles.

In the second phase, collection and analysis of quantitative data was conducted through the online survey tool, Qualtrics. The population of interest was Car:Go drivers in Belgrade, the only city in which Car:Go operates. Based on newspaper sources and the responses of Car:Go drivers, it has been established that the population consists of an estimated 1 000 drivers. The survey respondents were selected using exponential non-discriminative snowball sampling, in which Car:Go drivers would nominate multiple possible other Car:Go drivers who might complete the survey. The survey included 16 closed-ended questions, divided

between three topics: employment patterns; formal and informal work; and demographics. Specifically, the instrument measured the following variables: duration of working for Car:Go, reason for joining Car:Go, ownership of vehicle, main attractiveness of working for Car:Go, working time, shift work, type of contract, employment status before joining CarGo, duration of unemployment before Car:Go, participation in the informal economy before Car:Go, education level, age and gender. A total of 90 surveys were collected between June 2019 and December 2019.

Lastly, collection and analysis of qualitative data was performed using in-depth interviews. The interviews followed a semi-structured script to help the researcher better understand the Car:Go experience. Participants were randomly selected using the Car:Go application to obtain the hail-riding service in Belgrade. The challenge of such a sampling is that the drivers who drive for longer hours had a higher probability of being selected compared to drivers who drive for a smaller number of hours or who work late night or early morning shifts. Interviews were performed face-to-face, lasting an average of 20 minutes; they were conducted in Serbian, and later transcribed and translated into English. In-depth interviews with 30 Car:Go drivers uncovered valuable data, gleaned not only through the drivers' words, but by observations of their body language, pauses and expressions that otherwise might have gone unnoticed.

The research design helped to ensure greater understanding of the Car:Go drivers' perspective. The selected methodology was informed by the main features of qualitative research as defined by Yin (2016): studying the participants in real-world

Table 8.1. Data collection methods used in the research, June–December 2019

DATA COLLECTION METHOD	DATA COVERAGE
1. Document analysis	Reviewed documents including government policies, newspaper articles, Car:Go website and journal articles.
2. Conducting an online survey with 90 Car:Go drivers	90 drivers surveyed through the online survey tool 'Qualtrics, a structured questionnaire with 16 close-ended questions, using exponential non-discriminative snowball sampling.
3. In-depth, face-to-face interviews with 30 Car:Go drivers	Semi-structured, face-to-face interviews held with 30 drivers (around 20 minutes each). Each interview was conducted in Serbian, then the recording was transcribed and translated into English. Participants were randomly selected using the Car:Go application to obtain the hail-riding service.

Source: Author's own elaboration of the research phases.

situations; representing the views and perspective of the participants; explicitly attending to real-life conditions; and acknowledging multiple sources of evidence.

The author recognises several limitations of the research, the main one being that the particular nature of the subject makes it difficult for the findings to be generalised to other countries or other parts of the platform economy. However, the insights may be used to inform other cases, depending on 'the degree of similarity of the sending and receiving contexts' (Lincoln and Guba, 1985, pp. 122–3).

8.3 Main findings and discussion

The primary aim of the study was to discover how the first Serbian ride-hailing operation is changing employment patterns and how it is influencing informal employment. However, the design of the survey and the richness of the in-depth interviews provided the research with additional insights, primarily into the business model of Car:Go and some characteristics of Car:Go drivers.

8.3.1 The Car:Go business model
The first Serbian ride-hailing start-up, 'Car:Go,' initiated its operations in Belgrade in 2015. It started by operating as a provider of limousine services, registered in accordance with laws regulating tourism[4]. The platform enabled its customers to rent a car with a professional driver. The cars and drivers were provided by partner rent-a-car companies. Car:Go's revenue was based on a percentage charged for using the platform. The company started small, with just 30 cars (Stevanovic, 2018). With little government attention and lack of regulation, Car:Go operated without many difficulties for nearly three years. However, during the spring of 2018, taxi associations began protesting and demanding that the government close down Car:Go. At the time, Car:Go had grown to run approximately 100 vehicles. The taxi drivers' demands were based on the fact that Car:Go operated under the law regulating tourism, when in fact they were performing transportation services. Avoiding the strict rules of passenger transportation, Car:Go presented the taxi drivers with unfair competition (Djuric, 2018).

At the beginning of 2019, changes made to the regulations concerning passenger transportation

almost halted Car:Go's operations. In response to these regulatory changes, in February 2019 Car:Go established itself as a 'citizens' association'[5] with the aim of providing innovative road assistance to its members (Crnjanski, 2019). Actively registered as a citizens' association for innovative road assistance rather than passenger transportation, the Car:Go platform continued operating and expanding. In just a few months, it became the largest citizens' association in Serbia, with over 750 000 members (Radio and Television Network B92, 2019), including users (clients) and approximately 1 000 drivers (CarGo, 2019).

Currently the Car:Go business model is based on membership as a requirement to access the application, both for providers and users. This membership is achieved simply by registering on the application. Once registration is confirmed, an email containing a digital membership card is sent to the applicant. In order to carry out and solicit the service, drivers and users need a smartphone, internet connection and the Car:Go app. The service provided is defined as a 'modern technological platform – aggregation of software that allows users of Car:Go to make contact with third parties who are registered to provide the service of passenger transportation' (Car:Go, 2019). As reported during the interviews, Car:Go has approximately 50 partner companies, or sole proprietors[6], who employ between 10 and 40 drivers each. The idea behind this partnership is that Car:Go, as a platform, serves as an intermediary between users and drivers who are employed by partner companies that actually provide transportation services.

Car:Go currently offers services in three categories: Mini, Eco and Business. The main differences between these categories are price, type of vehicle and ownership. The 'Mini' category describes the service provided by drivers who are using their own vehicle. The 'Eco' category was introduced in response to the company's idea of promoting green and sustainable transportation. To this end, Car:Go acquired a number of hybrid vehicles. Drivers who

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[4] Law on Tourism, *Official Gazette of the Republic of Serbia*, Nos 36.09, 88/10, 93/12, 84/15.

[5] In Serbian legislation, a 'citizens' association' is defined as a voluntary, non-government and non-profit organisation established on the principles of freedom of association with the aim of fulfilling and enhancing the goals of the association or other common goals.

[6] Under Serbian legislation a sole proprietor is a natural person who is registered to conduct business activities in order to make a profit and who is liable for his obligations with all his/her personal assets. They can be self-employed or have employees of their own. Income tax for a sole proprietor is calculated on the basis of their actual income or on a flat rate. Sole proprietors are obliged to make mandatory social contributions – e.g. in terms of pension, disability, health and unemployment benefits – for themselves and their employees, if applicable.

provide a service with their own car can do this in both the Mini and Eco categories provided that their vehicle complies with the requirements of size, age and comfort. The newest category is the 'Business class', introduced with the idea of satisfying more demanding users by providing a luxurious service with a higher class of vehicle and drivers in uniforms. This category utilises only vehicles acquired by Car:Go and is the most expensive service level.

Based on the in-depth interviews, the researcher learned that the recruiting process is carried out by word of mouth – current drivers invite their friends or ex-colleagues to join Car:Go. There is no information about the hiring process on the app or on the internet. Regarding the selection process, the drivers stated that they are called for an interview and they need to pass a health check. If they want to use their own vehicle, the car has to be a model from 2015 or later and pass an inspection. In addition, a number of drivers mentioned that they received some form of basic training before they started working, without providing further details.

Through the in-depth interviews, it was revealed that there are three modalities for performing ride-hailing services: the first with the driver's own vehicle; the second involves renting a car from the company (Car:Go) for a period of 12 hours per day; and the third option is that of becoming a 'salaried worker' – as called by the interviewees. Drivers who utilise their own vehicle pay Car:Go a 30% commission from each ride, while drivers renting a vehicle from the company pay the same commission (30%) in addition to the approximately EUR 10 for a 12-hour vehicle rental. In the last modality, those who identify themselves as 'salaried workers' earn income based on the level of their achieved target: if they fail to reach the target, they earn a smaller percentage of their earning goal. Similarly, when they exceed the target, they receive a percentage increase of their earnings.

Within the last modality, the driver is given a car by Car:Go for a period of 12 hours each day, either during the day (6 am to 6 pm) or at night (6 pm to 6 am) and assigned a weekly target to achieve. The driver has no obligation to pay the expenses incurred from the use and maintenance of the car, and his or her salary is calculated according to the set target. According to the survey responses, the drivers are equally divided among those who use their own vehicle and those who use cars provided by the company. Among the latter, the majority (85%) define themselves as 'salaried workers', while just 15% rent the car from the company in order to perform ride-hailing services. Among the

participants who use their own vehicle, 95% use their own car, while 5% rent from another entity.

The organisation of the workforce depends on the above-mentioned options: those who use their personal vehicle to perform services are free to organise their own work, while those who use the company's vehicles are organised in pairs, i.e. in shifts of 12 hours each, with the obligation to be online for at least 10 of those 12 hours. The expenses incurred as a result of the services differ, based on the vehicle ownership: the drivers of their own vehicles are responsible for the cost of repairs, fuel, amortisation and other costs, while the 'salaried workers' do not pay these expenses. The data collected from the interviews suggests that the Car:Go business model was in the process of shifting in two ways. The first movement is from drivers with their own vehicles to drivers driving company cars, and the second shift is the push towards a 'one car – one company' model, as one of the interviewees explained it (personal communication, 2019). This latter new model creates an arrangement where one of the two people using the company's car would register as a sole proprietor[7] and hire the other as his employee.

Drivers are constantly monitored and supervised by several means: GPS features that allow the constant monitoring of their location, cameras in cars, announced or unannounced checks, and a rating system. As stated by some of the participants, the company is monitoring 'where I am, what I do, whether I am online, why am I not taking a trip request' (personal communication, 2019). Also, there is a rulebook that stipulates conduct, the required state of the vehicle, and the penalties for not abiding by these rules. For example, some of the stipulations are concerned with a dress code, hygiene, cleanliness and alcohol levels. Adherence to the rules is monitored through unannounced checks during which the state of the driver and the vehicle are graded. When violations occur there is a three-strike procedure: for the first infraction the driver is penalised by a reduction in salary; for the second the driver is taken off-line for a week; and for the third the driver is taken off the platform permanently.

The value capturing of the Car:Go business model comes from several sources: customers, drivers and vehicle rental. The customers pay per ride, based on the trip's distance and the category of the car, according to the established pricing posted on the website. All payments are done in Serbian dinars,

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[7] See footnote 6 for the definition of 'sole proprietor' under Serbian legislation.

and all fees and taxes are included in the fare that the customer pays. Once the ride is completed, the payment is made through the Car:Go app. The app accepts payment via debit cards, credit cards or PayPal, and tips may also be included after the trip is completed.

8.3.2 Characteristics of Car:Go drivers

Based on the survey findings, the average Car:Go driver is male, between 36 and 45 years old, and has most likely completed a four-year upper secondary education, predominantly at ISCED 3 level[8]. Only 3% of Car:Go drivers are female, as driving is still considered a male profession in Serbia. One of the rare female interviewees described the situation like this: 'It is considered a man's job, but I think I drive better than most men' (personal communication, 2019). One quarter of Car:Go drivers are younger than 35 years, and 13% have some or complete tertiary education. The majority of Car:Go drivers (87%) reported that the income from working as platform drivers represents their main source of income, while just 13% reported that they drive in order to generate some additional income.

Half of the participants said that they have been working for CarGo for six months or less. Based on the in-depth interviews, the research was able to establish that this is mostly due to the fact that, even though Car:Go has existed in Serbia for five years, it has experienced a massive expansion in the last 6–12 months. Also, an important finding was that 22% of Car:Go drivers had been working for more than a year, while 28% of the participants had been engaged in ride-hailing services for more than six months but less than a year. The in-depth interviews revealed two important characteristics of Car:Go drivers. Firstly, the turnover rate is high. As one of the interviewees put it: 'everyday there is one quitting and three more coming' (personal communication, 2019). The second finding suggests a trend of people transitioning to Car:Go who had worked in the same sector before (e.g. drivers in private companies, private or tour operator drivers) or people who had performed similar tasks in other sectors (e.g. the delivery and selling of merchandise, sales representatives), in search of a higher income. This finding is supported by 47.5% of the survey participants who said that the

reason they joined Car:Go was to earn more money compared to other lower-income employment options. A second group of 40% of participants stated that they joined Car:Go because they did not have other employment alternatives, and 12.5% became Car:Go drivers in order to make extra income. During the in-depth interviews, some of the participants who stated that they had no other alternative, also mentioned a health factor that prevented them from staying in their previous job or occupation. Others said that this was the only option they could find: 'Why do I work for Car:Go? Well there is nothing else' (personal communication, 2019).

Most of the participants (70%) transitioned from other employment to Car:Go, while the other 30% were unemployed before starting to drive for the company. Of those who were working previously, 44% performed work within their occupation, while 40% were engaged in other work. Fourteen per cent of the respondents had been made redundant from their previous job, while for only 2% this was their first job. A repeating theme was found among some of the interviewees who stated that they had worked in one company for a long time, but the company had ceased to exist, and they had started to provide ride-hailing services either to bridge the time until their next employment or because of a failure to find a new job. Several interviewees mentioned this predicament, but this one described it best: 'I started doing this while looking for a new job, but here I am one year later, still driving' (personal communication, 2019). This indicates that this sector of the platform economy does not have a high labour integrative function. Also, evidence shows that people engage in this activity to supplement their earnings, or even their own entrepreneurial activity, but end up with it comprising their sole income. In this vein, one of the interviewees stated: 'I have some shops. I started working with my car to get some extra income, to pay the bills for the shops, but then I started working full time' (personal communication, 2019).

Survey participants were also asked about their satisfaction with working in the platform economy. More than half (65.8%) responded that they are most satisfied with the income, followed by the flexibility and autonomy of the work (23.7%). Also, an important number of participants expressed that what they liked most about driving for Car:Go is that they experienced comparatively low levels of stress. In-depth interviews provided a better understanding of the different views: those drivers who use their own car value flexibility and autonomy, while those who drive a company car have no flexibility in terms

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[8] 'Secondary education' here corresponds to upper secondary ISCED 3 level. In Serbia this upper secondary education is provided in academically oriented high schools for a duration of four years, in vocationally oriented high schools for a duration of three or four years, and in arts-oriented high schools for a duration of four years.

Figure 8.1. Demographic characteristics of Car:Go drivers
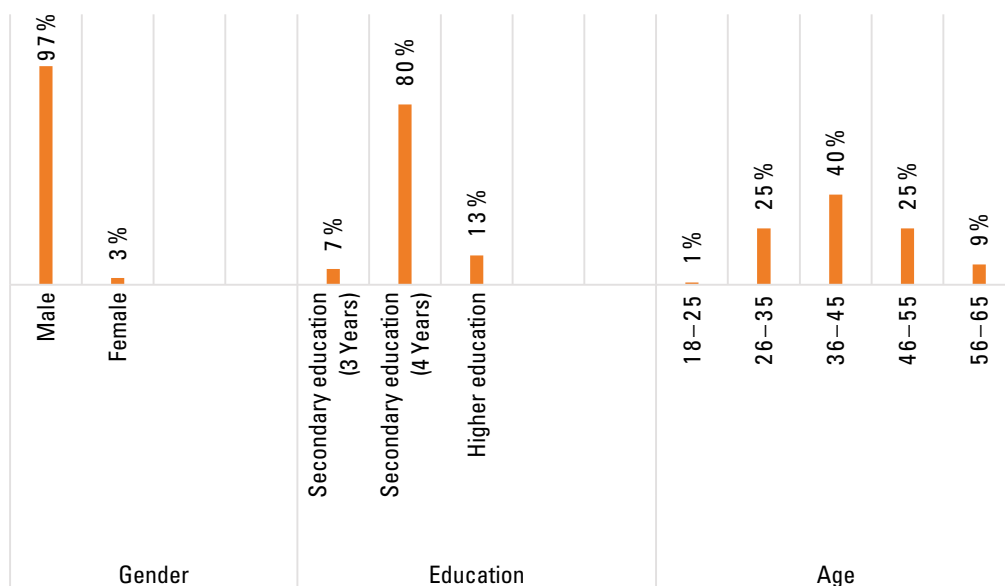
Source: Author's calculation using the data from the online survey and in-depth interviews, as described in Section 8.2 (Methodology).

of working time. However, both categories seem to be satisfied with the income, as one of the participants said: 'The way salaries are here, I am very satisfied' (personal communication, 2019).

Among those who value a lack of stress, the research found that they belong predominately to the group of people who transitioned from other similar jobs where, in addition to driving, they had other responsibilities. 'In my previous job, I had to spend a lot of time driving, but with the additional stress of creating invoices, handling money and […] then I heard about this, and the salary is better and it is less stressful', said one of the interviewees (personal communication, 2019). Another quote paints an even more vivid picture: 'I would work for nine hours for RSD 40 000, there were days I didn't know where my head was, I was doing invoicing, responsible for petty cash, and they used to call me all the time [...] I used to drive with my feet, eat with one hand and look for papers with the other' (personal communication, 2019).

The last finding among the drivers of Car:Go is that there is a prevalent desire to transition to becoming a legitimate taxi service provider. As one of the interviewees simply put it: 'I would rather drive a taxi, but I cannot get a taxi licence' (personal communication, 2019). This refers to the high barriers in the Serbian passenger transportation market, where prior licensing is necessary. Many interviewees mentioned the obstacles that prevent

them from offering a taxi service, such as the inability to take the required test of familiarity with the city's street network because the exam has not been available for the last seven years.

8.3.3 Employment patterns and labour rights of Car:Go drivers

All the survey participants declared that their work is based on a written contract. In trying to understand what types of contract the drivers of Car:Go have, based on the surveys and the in-depth interviews, the research uncovered three dominant forms: a fixed-term employment contract, self-employment and a contract of supplementary work.

First, the research found drivers who have written employment contracts. The contracting parties here are the drivers as employees and Car:Go partner companies or sole proprietors as employers, rather than Car:Go itself. One of the interviewees allowed the researcher to see their contract: it was a standard fixed-term employment contract with a duration of three months. It stipulated that the employee is entitled to a limited working time of eight hours per day, rest during working hours, daily and weekly rest, holiday and minimum wage, in accordance with the Serbian labour legislation. Further interviews suggested that this is the type of employment contract that all drivers with the status of employees have. It is worth mentioning here that, as one of the forms of temporary

employment, fixed-term employment contracts are restricted by Serbian labour legislation. They can be concluded when the duration of the employment is objectively predetermined. The legislation does not pose any restrictions in terms of the number of contracts, but it does limit their duration to a total of 24 months, with some exceptions (the replacement of a temporarily absent employee and project work, among others). This raises the question of what will happen to those employees after 24 months when they can no longer legally conclude fixed-term contracts. There are several options: they may be transformed into full-time workers, continue to work as fixed-terms workers despite the legal limitation or, as seems most likely, they will be forced to change their status to self-employed.

This employment situation for the majority of Car:Go drivers implies a higher level of insecurity in terms of remaining employed and earning, especially considering that for most of them this is their sole income. In addition, the research found discrepancies between the rights guaranteed by the labour legislation, the employment contracts and the experience of the drivers. The use of multiple fixed-term contracts prevents employees from obtaining wider labour rights. In addition there is evidence of situations of informal employment in the formal sector, described by one of the interviewees as: 'Yes, as per the terms of our contract, we have all the rights, but in practice I work 12 hours, I don't have paid vacation, and I don't know what is going to happen if I get sick' (personal communication, 2019). In reality, the drivers must fulfil their weekly targets if they are to receive the promised income. This means that if they decide to take a vacation or stay at home because of sickness, they will not be able to meet their target, and thus not realise their full income. Regarding earnings, the contract guarantees a minimum wage. In reality, salaries are higher than the Serbian average wage of EUR 500 per month, which is the reason why many join Car:Go.

Another important labour right and marker of job quality are the hours worked. The survey showed that 90% of the participants work, on average, between eight and 12 hours daily, or 60 hours a week. Based on the interviews, most drivers work six days a week, taking one day off to rest. There seems to be little difference in the effective hours of work of those who use their own vehicle and enjoy the freedom to set their own hours, and those who use the company's car and are obligated to complete 12-hour shifts. The reason for this is that both groups are driven by income generation, which results in simple maths: 'The more I drive, the more I earn', as one interviewee put it, or:

'I make good money, but I spend 10 to 12 hours driving' as another interviewee stated (personal communication, 2019). However, these working hours are especially problematic for those Car:Go drivers who have the status of employees, in which case national legislation limits their working hours to 40 per week, or 48 hours including overtime. The long working hours pose a risk to Car:Go drivers' health, but also raise a question over the safety of their passengers and other road users. During the in-depth interviews, the research uncovered that the excessive working hours are one of the reasons for the high turnover among drivers, as they can experience burn-out symptoms after only a few months of driving. 'Young people come, and they think they can make good money and that they can drive for 15 hours a day, but after 3–4 months they quit' (personal communication 2019).

Among the drivers of vehicles provided by Car:Go, the working schedule is determined by the company, which has set the rule of 12-hour shifts: the first shift starts at 6 am and ends at 6 pm and the second shift starts at 6 pm and ends at 6 am. From the interviews, the research found out that there are multiple modalities to working in shifts: some drivers elected just to work during the day, others work only during the night, while in other cases, drivers change shifts. Half of the survey participants stated that their work is organised in shifts of 12 hours, while the other half claimed not to work in shifts. This is consistent with the results of the car ownership question, where participants were equally divided between those who use their own car and those who drive a vehicle provided by the company. Interviewees are not in total agreement when it comes to working in shifts: those who had performed night work before had no difficulty in adjusting to this schedule; others expressed some concern – as one of the interviewees said: 'For the first time, I am doing night shifts. I am not sure I am going to make it' (personal communication, 2019).

Regarding other labour rights, the research discovered that all Car:Go drivers have social security coverage such as pension, disability, health (including medical insurance and insurance in the event of injury at work and occupational disease) and unemployment insurance. In addition, they receive some type of training prior to starting work and have technical support with regard to the functioning of the app as well as in the case of car repairs and breakdowns. The research did not investigate the right to be represented by a trade union or the right to collective bargaining, nor did any of the interviewees mention exercising these rights.

Looking at the contractual form of the majority of the drivers and the attributes of the job, the research found that Car:Go engages in non-standard types of employment, such as fixed-term contracts and disguised employment. Also, the research found elements of precariousness, especially insecurity about continued employment, income-earning and no or minimal workers' control over working conditions.

It is important to mention the category of workers who have self-employed status. Here we cannot talk about labour rights, as the national labour legislation does not cover this group of workers. However, it is notable that, according to the national regulation, all self-employed people have social security coverage. At the time this research was conducted, only 15% of drivers for Car:Go reported that they had self-employment status; nevertheless, there is an indication that this percentage may increase. A number of interviewees mentioned that Car:Go was exerting pressure on them to open sole proprietorships and become self-employed: 'they are pressuring me to open my own firm. Their plan is that each car is one firm', reported one of the drivers (personal communication, 2019). Another driver stated: 'I have three years to pension. I opened my own firm when I started driving for Car:Go. They asked me to register other drivers in my firm, but I declined.' These findings indicate the presence of involuntary and bogus self-employment.

8.3.4 Informal employment among Car:Go drivers

The employment characteristics of Car:Go drivers suggest a hybrid nature when it comes to its formality or informality. Car:Go drivers are not employed in the informal sector, nor do they fall strictly under the definition of informal employment; they are in quasi-formal employment. All survey participants stated that their work is formalised, and this was confirmed by the in-depth interviews. One of the interviewees was very explicit about this: 'Nobody works informally. You cannot work if you are not registered' (personal communication, 2019). The survey results indicate that the majority of drivers are subject to national labour legislation, income tax and social protection regulation based on the employment relationship. Fifteen per cent of drivers are self-employed, while 7.5% declared that their principal tax and social contributions are tied to their main work, but that they pay additional tax and social contributions for their supplementary activity. However, the in-depth interviews revealed the existence of the widespread informal practice of paying drivers through so-called 'envelope wages'.

This means that 'formal employers pay their formal employees two wages, one declared and the other an undeclared or "envelope wage"' (Williams, 2009, p. 156). Many interviewees used the terms 'in hand' to describe the cash payments and 'in paper' to describe the formal salary stipulated by employment contract: 'In paper, everything is minimum wage, I get the rest cash in hand' – said one of the interviewees (personal communication, 2019).

Another important aspect of this quasi-formality is that there seems to be a division among drivers, vis-à-vis this system: some are aware of the illegality of not declaring their full wage and are concerned about their future pension levels. Others, however, are satisfied with the fact that they are covered by pension and social security schemes but are not worried about the level of such coverage. The reason for the latter position may be, as in other transition countries of Central and Eastern Europe, a loss of trust in institutions and the recent actions taken by the Serbian government to reduce pensions. As one of the interviewees mentioned: 'Why should I pay all that now when I don't even know if there will be a pension in the future' (personal communication, 2019).

Lastly, the platform economy is not commonly seen as a generator of the informal economy. Some even believe it can facilitate a transition to the formal economy. For this reason, the research asked survey participants whether driving for Car:Go helped them transition from informal to formal employment. The majority of the participants (89%) said that they had worked in the formal economy before joining Car:Go, while 11% declared that Car:Go did help them transition from the informal economy to formal work. Unfortunately, the research did not achieve a deeper understanding of this phenomenon from the in-depth interviews, as participants exhibited anxiety when asked about these issues. One of the statements the interviews did elicit may describe it best: 'I used to work informally, but now I am registered. I pay all contributions and taxes, but it doesn't mean much to me' (personal communication, 2019).

8.4 Comparison with similar research and conclusion

In this section, the findings are compared with those from studies conducted on the platform economy and platform work in other parts of Europe and the world, and also in terms of the general working population of Serbia.

8.4.1 Ride-hailing business models

In many countries, the transportation service sector has a high barrier to entry, requiring the prior authorisation or licensing of applicants. An important step in regulating ride-hailing services is determining their main economic activity. The International Labour Organisation's (ILO) Resolution on Transport Network Companies emphasises the need for all related companies to be covered by a specific regulatory framework (ILO, 2015). Uber has been a prominent case, portraying itself as an 'information society business'. Across Europe and in the Court of Justice of the European Union, it has been argued that Uber is not an intermediary but a 'genuine organiser and operator of urban transport' (Prassl and Risak, 2015, p. 637). Uber's indirect control through financial incentives and a rating system implies an effective management of workers. For these reasons Uber cannot be considered as a mere information society business, but rather should be seen as a transportation service company. Research shows that platforms often impose performance criteria, timing and price (De Stefano, 2017).

The Serbian transportation sector has similar high barriers for new entrants. In order to circumvent these barriers Car:Go started its economic activity in the tourism sector, and now operates as a citizens' association. Similarly to Uber, Car:Go also defines itself as a technological platform, acting as an intermediary between transportation service providers and customers. The earlier protest by taxi drivers boiled down to the determination of the kind of service Car:Go is delivering. The question of the main economic activity of Car:Go is still under debate.

Regarding the business model itself, the research found other more unique features of the Serbian ride-hailing service, Car:Go. Uber bases its business on a shared economy model of utilising one's own resources to generate income. In contrast, Car:Go introduced a new business model of acquiring vehicles and making them available for people to rent or use as a working tool in order to provide ride-hailing services. The recruitment model is also different: where Uber allows people to apply for a job directly through the app, the hiring process in Car:Go is mostly carried out by word of mouth. The monitoring and supervision of drivers are enhanced by cameras and physical controls. The most significant difference in the business models of Uber and Car:Go is certainly the dominant employment pattern: Uber drivers are individual contractors while Car:Go drivers are predominantly employees of Car:Go partner companies or sole proprietors.

8.4.2 Characteristics of platform workers

There is an image of platform workers as young, highly educated professionals making additional income on the side (Joyce et al., 2016; Berg, 2016). However, the characteristics of platform workers seem to differ, depending on the tasks that are performed.

Research into the characteristics of Uber drivers in the USA showed that the predominant age group is 30–39 years, only 13.8% are women, and that most of Uber drivers have either attended or graduated from college (Hall and Krueger, 2015). The European Trade Union Institute surveyed platform workers in five Central European countries (Bulgaria, Hungary, Latvia, Poland and Slovakia) and found that the average worker who offers a taxi service or other driving and delivery work is in their mid to late thirties (34–40 years old) and that there no significant gender disparities among taxi and food delivery workers (Piasna and Drahokoupil, 2019). Other research found that drivers would use Uber to supplement their income and did not want to become taxi drivers, nor be associated with them (McGregor et al., 2017). Using platform work to supplement one's income seems also to be the case across Europe; however a substantial number of people depend on the platform economy as their sole source of income (Fabo et al., 2017).

The case of Car:Go suggests a higher gender disparity in ride-hailing platform work in Serbia. However, in demographic characteristics pertaining to age, there seems to be similarity between Car:Go drivers, Uber drivers in the USA, and taxi and food delivery platform workers in Central Europe. Also, for most Car:Go drivers, providing ride-hailing service is their main source of income, and there is a strong desire to become a taxi driver instead of working for Car:Go.

The research also looked at comparing the demographic characteristics of Car:Go drivers to those of the general working population in Serbia. Comparatively, among Car:Go drivers there is a higher proportion of both workers with

secondary education and male workers, as shown in Figure 8.2. Comparing age categories, a noticeable difference was found in the lower percentage of Car:Go drivers over 56.

8.4.3 Employment patterns and labour rights

In the literature it is argued that the transformative power of platforms to change traditional employment activities into self-employment is perhaps the most important effect of platforms on labour (Drakopuli and Jepsen, 2017). Uber, for example, uses the term 'partner' when referring to its drivers and labels them as 'independent contractors', a subset of self-employment (MacGregor et al., 2017). However, studies have shown that platform workers are heterogeneous. While some may indeed be self-employed, others have more in common with employees, especially those providing transportation services (Yang, 2017).

Car:Go represents a unique case in which 77.5% of the drivers have the status of employee. However, it is important to mention that other researchers have found a tendency towards increasing self-employment, especially when platform work intensifies (Yang, 2017). There is growing concern among some researchers about people being pushed into becoming independent contractors. In this precarious, involuntary form of self-employment, the individual enjoys neither

the benefits of a regular full-time employment, nor those of self-employment (Kautonen et al., 2010). The findings of the Car:Go case study suggest this may be the case for some Car:Go drivers in the near future.

Regarding labour rights and social protection, the biggest concern about platform work is the lack of these entitlements for individual workers. A case study on Uber shows that drivers do not have a basic standard of labour protection: they do not enjoy the right to a minimum wage, vacations or regular working hours. In addition, they have to cover all the costs of wear and tear on their equipment (De Stefano and Aloisi, 2018). The Car:Go case shows some similarities with these findings, but also highlights other differences. While the majority of the Car:Go drivers are covered by employment contracts guaranteeing them labour rights, the rights to a limited working time or paid vacation or sick leave are not enforced. On the other hand, the income of the Car:Go drivers is almost double the average salary in Serbia. Also, all Car:Go drivers have social security coverage.

In terms of status, the general working population in Serbia is mostly retained through some form of employment relationship (72%), while 23% are self-employed, of whom the majority have no other employees and only 4% are self-employed with employees. Looking at the general working population in Serbia, the prevailing form of employment contracts is written (93%), with the majority of such contracts being indefinite (77%). Only 20% of contracts among the general working population are fixed-term, due to restrictive labour regulations.

With a view to labour rights, the majority of the general working population in Serbia works between 36 and 48 hours per week (69%); only 8% work 49 or more hours per week. Most of the workers in Serbia have social coverage: 93% of workers have pension rights and health insurance, 90% enjoy the right to paid sick leave, and 89% have the right to paid vacation (Statistical Office of the Republic of Serbia, 2019). In contrast, the research found that Car:Go has a higher share of workers with fixed-term contracts. Also, Car:Go drivers work more hours than the average worker in Serbia. However, the research did not find major discrepancies regarding the status of workers. Car:Go drivers, much like the general working population in Serbia, are predominantly employed, while there is a slightly lower level of reported self-employment amongst Car:Go drivers compared to the general working population.

Figure 8.2. Comparison of main demographic differences between Car:Go drivers and the general working population
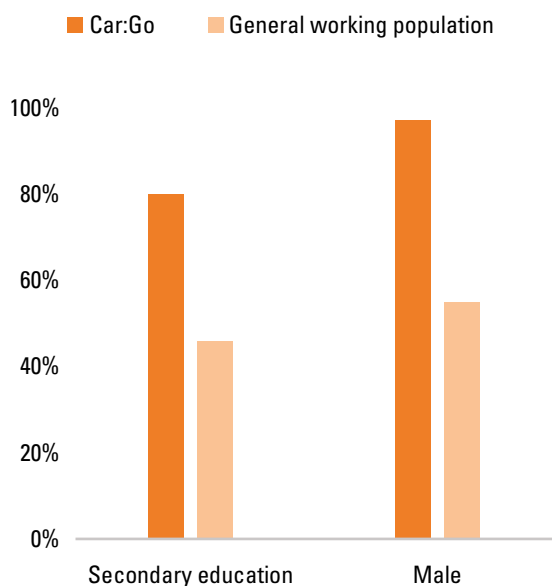
Source: For Car:Go drivers, author's calculation using the data from the online survey and in-depth interviews, as described in Section 8.2 (Methodology). For general working population, the Statistical Office of the Republic of Serbia.

8.4.4 Informal employment in the platform economy

An ILO study on trends and changes in employment patterns found that non-standard employment patterns take different forms, depending on the country's stage of economic development. In advanced economies, we see an increase of non-standard forms of employment, while in developing countries (including emerging and transition economies) a rise in informal employment is apparent (Beneria, 2001). A more recent ILO study (2016) illustrates the link between non-standard and informal jobs, especially in terms of a lack of legal protection. Research carried out in the 27 EU Member States discovered that 5.5% of formal employees receive envelope wages, with this practice prevailing in East, Central and Southern Europe (Williams and Horodnic, 2017). According to the Serbian Labour Force Survey (Statistical Office of the Republic of Serbia, 2019), 10.1% of employees work in informal sector businesses, i.e. businesses that are not registered. However, the total percentage of informal workers is 19.6%, of which 25.8% are employees and 45.8% are self-employed. The Car:Go case study did not uncover any unregistered workers, which implies that it may be contributing to the growth of formal employment. However, the research did reveal the widespread practice of encouraging undeclared work through the payment of envelope wages. The informal elements found within the formal arrangements point to a culture of tax evasion in Serbia on both sides – employers and employees.

In conclusion, this research found that the Serbian ride-hailing start-up Car:Go shares some similarities with other platform business models for transportation services, but also possesses some distinctive features. The most prominent distinguishing feature of Car:Go Serbia is its establishment as a citizens' association and the acquisition of its own vehicles. The research also revealed that the profile of Car:Go drivers differs from what is considered to be that of the typical platform worker but share similarities with platform workers providing transportation services in other countries. Compared to the general Serbian working population, the research suggests an overrepresentation of Car:Go workers with secondary education and an underrepresentation of female workers. An important finding is that the Car:Go case does not support the labour market integrative function of the platform economy; most Car:Go drivers had been employed elsewhere previously and there is no evidence of Car:Go being an effective stepping-stone to a better job in the future.

Regarding the employment status and labour rights of Car:Go drivers, the research discovered that the Car:Go model differs significantly from other ride-hailing platforms like Uber. The majority of Car:Go drivers have employee status and their income is significantly higher than the minimum wage. Looking at the contractual form of the majority of the drivers and the attributes of the job, it was found that Car:Go promotes non-standard employment types through contracting fixed-term employees and enabling disguised employment. Also, the research draws attention to elements of precariousness, especially insecurity about continued employment and income-earning, and drivers having no or minimal control over their working conditions. The major concerns about labour rights and protection in the case of Car:Go drivers include excessive working hours and the absence of paid holidays and sick leave, as well as the widespread informal practice of paying envelope wages.

The platform economy can make up for market deficiencies and allow people who would otherwise face high barriers to entry, access to the labour market. On the other hand, platforms operate by benefitting from a lack of regulation – or by adjusting and finding innovative ways to balance their business models under the existing regulatory framework. This, in turn, results in the creation of various types of hybrid models of employment patterns – disguised employment, quasi-formality, and so on. It is clear that the platform economy is not homogeneous, and that there is a need for multiple employment options in order to regulate all the different categories of workers found in the platform economy. When regulating the platform economy, attention should be paid to both the quantity and quality of jobs. While the particular features of this research make it difficult for findings to be generalised to other countries, it provides insights that can inform policy makers in Serbia. It also calls for similar research to be carried out elsewhere and comparative findings to be established, thus contributing to the growing body of literature on the future of labour and the effects of digitalisation on labour markets.

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PART 3

CHANGING DEMAND FOR SKILLS AND QUALIFICATIONS

SKILLS MISMATCH: MEASUREMENT AND POLICY IMPLICATIONS IN SELECTED COUNTRIES

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Skills mismatch is one of the explanations often given for high youth unemployment and labour market rigidities, but the exact extent of the problem is an unknown entity in the partner countries of the ETF. This article explains the concept and types of skill mismatch and provides an overview of the most promising methodologies for measuring mismatch quantitatively. Based on the ETF study skills mismatch calculation in 2017–18, carried out for seven partner countries (Serbia, Montenegro, North Macedonia, Moldova, Georgia, Egypt and Morocco), the article presents the methodological approach employed by the ETF, including the results, challenges and lessons learnt from its data collection and measurement process. The results show that labour market outcomes can be largely affected by skills mismatch, especially in the context of the changing dynamics of economies and societies. In order to measure and understand both the magnitude and the interrelatedness of the different forms of skills mismatch, a combination of indicators and analysis of results from different methods is required. A critical study of the various indicators is also included in this article, leading to suggestions for potential new methodological improvements. Finally, the article touches on the key policy implications for persistent or deepening skills mismatches.

9.1 Introduction

Skill mismatch is a term that is frequently referred to in policy debates. However, the concept itself is very broad and can include a number of variations. It is usually defined as a discrepancy between the demand for and supply of skills in the labour market but can be expressed in many different forms and with respect to a number of dimensions (European Commission, 2015; Cedefop, 2015).

Specifically, skills mismatch can be used to describe vertical mismatch (usually measured in terms of over-education, under-education, over-skilling and under-skilling), horizontal mismatch (typically comparing fields of study and work), skills gaps (the extent to which workers lack the skills necessary to perform their current job), skills shortages (usually measured in terms of unfilled and hard-to-fill vacancies) and skills obsolescence (certain skills can become obsolete due to ageing, through technological or economic change which renders them unnecessary or through the underutilisation of particular expertise).

Skills mismatches are generally restricted to those impacting workers in employment or companies currently employing or seeking to hire workers. Many of the mismatch indicators adopted in the literature have a number of drawbacks, and various approaches used to measure the same type of mismatch are often poorly correlated. All of this suggests that the use of the term skills mismatch within a policy context is highly problematic.

Measures of mismatch can be most usefully subdivided into those that are gauged at the level of the individual's circumstances, and those that are assessed in terms of firm-level aggregates. Individual concepts of mismatch relate to the degree to which workers in firms possess skill or education levels that are above, below or poorly connected to the requirements of their current job. In the case of vacancies, mismatch describes the extent to which the educational qualifications and skills of job applicants meet the needs of the hiring firm.

Skills mismatch is interconnected with human capital. Surplus human capital is typically measured

in terms of over-education[1] or over-skilling. However, surplus with respect to education may also be related to horizontal (or field of study) mismatch, whereby workers are employed in jobs that are not relevant to the skills and knowledge they acquired in formal education. Mismatches in human capital can also relate to skills obsolescence, whereby workers possess skills that employers no longer require, due to changes in individuals' abilities, technical progress or market conditions. Firm-level aggregates of mismatch are typically restricted to the study of skills gaps and shortages. Skills gaps describe the situation in which the employer believes that workers do not have the requisite competencies to successfully discharge their current role. Skills shortages are identified where employers are unable to fill key vacant posts due to a lack of suitability qualified candidates.

Skills mismatches reflect changes in the labour market, with some occurring at a rapid pace, particularly in transition and developing countries. Multiple transformations have shaped the economies and societies in the ETF partner countries under review here over the last decades, and such trends will continue and even increase in the context of economic and social shocks, such as, for example, the impact of the Covid-19 pandemic. Although it is very difficult to capture the multitude of types and dimensions of socio-economic transformations in these countries in a single snapshot, we can cluster the main factors influencing the incidence of skills mismatch under the following headings:

- sectoral shifts, as transition countries have moved from a centralised structure to a market economy model, or, in the case of developing countries, as traditional sectors have given way to more modern forms of working, such as mechanisation and modernisation in agriculture;
- changes in occupations and tasks due to digitalisation, enhanced technology and innovation or globalisation and changing production and trade patterns;
- demographic shifts caused by various phenomena, such as low fertility rates and an ageing population, or booming younger generations, or significant migration waves (inward or outward);
- education-related factors, ranging from improved retention in education and pupils staying in

school for longer, to the quality and relevance of education either rising or falling, or the presence of barriers impeding workers and jobseekers with obsolete skills from accessing or successfully completing continuous training programmes;
- individual-related reasons, such as the education and/or employment-related expectations in terms of social status, earning prospects, etc., leading to a biased choice of education/training programmes, career development opportunities or jobs.

Analysing the incidence of skills mismatch is essential in the context of managing transitions to future jobs and matching the emerging occupational requirements with the right mix of skills. Such research can reveal the past and present inefficiencies in human capital development and utilisation. For example, a boost in the provision of and enrolment in certain education programmes, particularly at the tertiary level, in response to skills forecasts signalling a certain demand in the short to long term does not necessarily lead to a well-matched or sustainable integration of graduates into the labour market. Rather, conducting multifaceted research on skills demand and actual skills utilisation in the economy can more efficiently guide the choice of policies and measures suitable for mismatch prevention and mitigation or reduce periods of 'mismatched' employment. Underlying conditions and causes can be manifold; therefore, an in-depth identification of mismatch triggers is required to secure effective policy responses.

9.2 Skills mismatch: types, measurements and empirical evidence

The concept of skills mismatch entails various forms and dimensions of labour market imbalance. Although the term is widely used in the literature and policy documents, skills mismatch reflects a rather generic idea, encompassing various definitions or measurement methods. Beneath the surface, it can manifest itself in multiple forms and have different underlying causes. Therefore, skills mismatch is a complex phenomenon, expressed in different types and dimensions of labour market conditions. In order to measure and understand the magnitude and interrelatedness of the different forms of skills mismatch, a combination of indicators and analysis of results from different methods is required.

Generally, skills levels are measured based on one or more of the following three factors: the nature of the work performed and the minimum education

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[1] The policy literature tends to favour the word 'over-qualification' rather than 'over-education' on the grounds that it is always best to have more rather than fewer educated people. There is a similar aversion to the term 'over-skilling' as it is believed that having more skills on the whole is a good thing.

and amount of on-the-job training required. Most of the emphasis is placed on the first two components with little attention devoted to the third. However, given that the information on individual human capital captured in the datasets tends to be restricted to levels of educational attainment, evidence regarding the first and last factors is generally overlooked in assessing mismatch status (McGuinness et al., 2017).

Mismatch can be measured along several axes. Perhaps the most fundamental of these is the distinction between a mismatch of skills and a mismatch of qualifications. Qualifications are awarded as a formal recognition that someone possesses a given skills set. This does not imply that two individuals with the same qualifications have the same skills, or that they can call on certain skills to the same extent. Qualifications thus remain approximations of a person's skills set, and we cannot assume that a qualification mismatch is equivalent to a skills mismatch, or vice versa. It is possible to be over-educated, but under-skilled; for example, in a situation where a person with tertiary education is working in a position that only requires secondary education, the tertiary graduate is considered over-qualified, but it may well be the case that this person lacks some of the practical skills necessary to perform the job and thus is under-skilled. Since skills are not always formally recognised, it is also possible to have the inverse situation, where the actual skills of an employee are being fully used, but the employee does not have the level of education believed to be necessary for the job. Such a person can be characterised as under-qualified if only the educational attainment is taken into consideration.

Presumably, in most cases, a prospective employer is likely to be more interested in the particular skills set of an individual than their actual educational attainment level. Employers should therefore place greater emphasis on skills than qualifications. However, skills can be difficult to measure and – in the absence of reliable data – educational attainment is often used as an imperfect proxy for skills.

Another measurement axis is the distinction between 'horizontal' and 'vertical' mismatches. A 'horizontal' mismatch occurs when there is a discrepancy between the types of skills (or fields of study) in which a person has proficiency and the requirements of their job. A 'vertical' mismatch occurs when the levels of education/skills which a person possesses fail to meet the demands of their job. Finally, a third axis distinguishes between quantitative and qualitative mismatch (Fetsi, 2011). Qualitative mismatch is similar to horizontal

mismatch, whereas quantitative mismatch is a description of the fit between the number of people holding certain qualifications and the number of jobs available that require such credentials (the same as qualification shortage or oversupply).

In the light of the above discussion, the main types of mismatches can be summarised as follows:

- Over- and under-education are the two most common (and frequently studied, see below) types of mismatch. They are forms of so-called 'vertical' mismatch[2], which describes the relationship between a person's level of education/formal qualifications and the requirements of their job. They can be measured *subjectively* (through a self-assessment by the worker of the level of qualifications required to obtain/perform the job), *empirically* (estimating the educational requirement of an occupation by calculating the mean/modal level of education of those within a given occupation) or with the *help of job analysts* (who are tasked with measuring the educational requirements of occupations). It is also possible to identify over- and under-education by using the International Standard Classification of Occupations (ISCO), which categorises major occupational groups by level of education in accordance with the International Standard Classification of Education (ISCED). The skill level is measured based on one or more of the following factors: the nature of the tasks involved; the minimum level of education required; or the amount of informal on-the-job training necessary to carry out the job[3]. Using ISCO 08, skill levels can be assigned to major occupational groups. For example, ISCO categorises legislators, senior officials and managers (ISCO 1) as requiring a tertiary level of education (ISCED 5–8)[4]. Also, ISCO major groups 2 and 3 typically require the completion of tertiary levels of education (ISCED 5–6), while the major groups 4–8 are typically associated with medium levels of attainment (ISCED 3–4). The last major group, 9, includes occupations for which no education or qualification level is

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[2] A vertical mismatch occurs when there is a discrepancy between the levels of education/skills which a person possesses, and the requirements of the job they hold.

[3] Typically, the only information on individual human capital captured in the datasets tends to be restricted to levels of educational attainment, meaning that and this is the factor most often used in the calculation of skills mismatch.

[4] As noted by Quintini (2011), this measure relies on the assumption that all jobs with the same title require the same level of education and that this is true in all countries using the same occupational classification. Most ETF partner countries are able to provide standardised information on education and occupations based on ISCED and ISCO categories.

required (i.e. elementary occupations). A more detailed description of the correspondence between occupations, education and skills is presented in Table 9.1.

Such occupation-education correspondence is somewhat arbitrary given that there are many differences across countries or exceptions within some occupational groups, depending on professional or other statutory regulations. A concrete example of this is the way in which the requirements to practise advanced health-related professions, such as highly specialised nursing and midwifery roles, evolved from requiring medium-level qualifications to demanding the completion of (short) tertiary-level education programmes. Nevertheless, using international standard classifications to reference skills mismatch assessments in the areas of labour market/occupations and education ensures a certain degree of reliability and comparability across different countries.

- Over- and under-skilling are also forms of 'vertical' mismatch, describing situations where workers' beliefs about their skills diverge from the requirements of their jobs. Such mismatches are measured most often by human resources specialists and are seldom captured by datasets. Over-skilling may be a more comprehensive measure of mismatch as it entails the worker comparing all their skills and abilities, irrespective

of whether they were learnt in the classroom or work environment, with the actual requirements of their current job. Some have argued that over-skilling is a more accurate measure of mismatch amongst existing workers than over-education (McGuinness et al., 2017).

- Horizontal mismatch measures the extent to which workers are employed in an occupation that is unrelated to their principal field of study. It can be gauged either independently by comparing a field of study variable with occupation codes, or by using a subjective question which asks the respondents to assess whether their current job is related to the study field of their highest qualification.
- Skills obsolescence can arise due to technological or economic change (rendering certain skills unnecessary) or through the underutilisation of skills, which may then be lost, while workers can also lose certain abilities due to ageing (which may impair manual skills, for example). These factors can be measured through questioning workers about their experiences.
- Skills gaps measure the extent to which workers lack the competences necessary to perform their current job. They are usually measured by collecting information from employers (mostly through surveys) regarding the perceived skill deficiencies of workers. It has been argued in

Table 9.1. Correspondence between occupation, education and skill levels in the calculation of mismatch

MAIN OCCUPATIONAL GROUPS (ISCO-2008) ONLY 1-DIGIT LEVEL	CORRESPONDENCE TO EDUCATION LEVELS	CORRESPONDENCE TO SKILLS LEVELS
1. Legislators, senior officials and managers 2. Professionals 3. Technicians and associate professionals	ISCED 5–8	Higher skills (tertiary education)
4. Clerical support workers 5. Service and sales workers 6. Skilled agricultural, forestry and fishery workers 7. Craft and related trades workers 8. Plant and machine operators, and assemblers	ISCED 3–4	Intermediate skills (upper secondary and post-secondary education)
9. Elementary occupations	ISCED 1–2	Low skills (no education and below upper secondary)

Source: ETF (2017).

the literature that skills gaps and under-skilling are similar and they are likely to be highly correlated; however, it is doubtful that the correlation will be strong in relation to all forms of mismatch.

Most of the research on skills mismatch focuses on surplus human capital, namely over-education and over-skilling. The existing evidence suggests that these phenomena impose costs on over-educated workers in the form of lower wages and a lack of job satisfaction compared to individuals with equivalent levels of education in matched employment. One of the most studied aspects of over-education is its effects on wages, with the evidence constantly pointing to a wage penalty for over-educated individuals relative to those with the same education in appropriately matched employment. However, over-educated workers are found to earn a premium relative to matched workers doing the same job (i.e. with lower level of education), suggesting that individuals do manage to raise their productivity levels in jobs for which they are over-qualified (for reviews see McGuinness, 2006; Quintini, 2011; Cedefop, 2015).

The effects of over-education on job satisfaction have been widely investigated, but the results in the literature are mixed: while some studies indicate that over-education leads to lower job satisfaction, others find that this is only the case when over-education is also accompanied by over-skilling. The evidence further indicates that over-education is more prevalent among graduates of the social sciences, services and humanities. The area of under-education has received far less attention in the literature so far and thus the empirical findings on under-education are very mixed. The existing empirical evidence on over-skilling indicates that it bears an associated wage penalty, with skilled individuals earning less than those with equivalent levels of education who are in matched employment.

Most of the existing data that allows for the measurement of skills mismatch relates to high income countries and, as such this is also the focus of most of the existing literature. However, more recently, some evidence of skills mismatch has emerged for low- and middle-income countries. Apart from the ETF initiative covering seven partner countries, the World Bank's Skills Toward Employment and Productivity (STEP) dataset collected information on 12 low- and middle-income countries, including four ETF partner countries (Armenia, Georgia, North Macedonia and Ukraine).

Using STEP data, Handel et al. (2016) find a high incidence of over-education across the countries reviewed, with over-education being more prevalent than under-education. Across the 12 countries, the average incidence of over-education was 36%, ranging between 22% (North Macedonia) and 70% (Vietnam), but these rates are, in any case, much higher than those found in more developed labour markets. Consequently, the incidence of under-education is much lower, 12.4% on average, ranging from 3.8% (Ukraine) to 40.4% (Kenya). From a policy perspective, Handel et al. (2016) note that skills development alone is not enough to generate economic growth in these low- and middle-income countries, it is also necessary to foster the creation of higher skilled jobs to ensure that the capabilities of those workers with the relevant expertise are fully utilised (McGuinness et al., 2017).

Handel et al. (2016) also investigate the determinants of educational mismatch across the 12 countries. Their findings are rather interesting and show that more experienced workers do not demonstrate a higher probability of under-education, that part-time workers are not generally mismatched and that gender does not play a role in explaining educational mismatch. Also, intriguingly, the incidence of over-education among graduates of humanities, the social sciences, health and law tends to be relatively low, whereas it is comparatively high for business graduates.

Data from the ILO's School-to-Work Transition Survey (SWTS) have also been used to study educational mismatch in low- and middle-income countries. Sparreboom and Staneva (2014) draw on SWTS data to identify educational mismatch in 28 countries, using a method which categorises major occupational groups by level of education in accordance with the International Standard Classification of Education (ISCED). They find a relatively high incidence of under-education in these countries (on average 37% of young people), and highlight under-education as the main policy concern, especially for low-income countries where, on average, half of the young people in non-vulnerable employment are under-educated.

9.3 ETF approach for measuring skills mismatch

To shed light on various forms of mismatch in its partner countries, in 2017–18 the ETF carried out a research initiative to investigate and measure the prevalence of skills mismatch in seven selected countries: Serbia, Montenegro, North Macedonia,

Moldova, Georgia, Egypt and Morocco[5]. In selecting these countries, a number of factors were taken into consideration: variety of socio-economic backgrounds and sectoral distributions; prevalence of an informal economy; and demographic outlook, including migration propensity, growth trends and the population's exposure to poverty. Although the calculation of the mismatch indicators resulted in relatively comparable numbers or incidences within the context of each country, in most cases the explanatory factors were completely different. For example, in Egypt and Morocco a bulge in the numbers of young people and labour markets under pressure from significant cohorts of new entrants may partly explain the high incidence in youth unemployment, while in the case of transition countries like Serbia, Montenegro, Moldova or Georgia, the lack of sufficient and attractive job opportunities delay young people's transition into employment and result in high rates of joblessness.

The ETF took an applied research approach which focused on a number of questions. What are the typical forms of mismatch seen in transition and developing countries, with focus on selected partner countries? What are the available datasets for mismatch calculation and to what extent are they accessible, reliable and internationally comparable? Is it feasible to define and collect a set of key indicators that reflect mismatch incidence in a comparable manner across countries? What are the major shortcomings in the calculation of various indicators? What are the main policy implications of mismatch given the socio-economic context of each country? How can the ETF and its partner countries take steps to secure a regular assessment of mismatch occurrence and dynamics over the years?

This section details several indicators used by the ETF to measure the incidence of skills mismatch. Each indicator has its strengths and weaknesses, which must be clearly laid out in the context of the ETF partner countries so that the recommendations can assist them in advancing their knowledge of skills mismatch. However, it is essential to assess what data are required for computing each indicator before making recommendations, as no methodology can be more reliable than the underlying data; the appropriate data sources are also indicated below.

1. The unemployment rate represents unemployed persons as a percentage of the labour force. The labour force is the total number of people who

are employed or unemployed[6]. This indicator provides a measure of the overall probability of being unemployed and the associated underutilisation of skills. Often quoted as a measure of skills gaps and imbalances in the labour market, the indicator fails to provide a robust picture of the incidence and causes of skills mismatches. It requires standard labour force survey (LFS) data, which are generally available in the ETF partner countries, although problems related to comparability may arise from inconsistencies in age groups or the use of different definitions.

2. The proportion of unemployed versus employed (unemployed to employed ratio) is an indicator that is calculated by comparing the number of unemployed people at a given education level with the corresponding number of employed people who have the same level of education. A major strength of this indicator is that it clearly indicates at which education level(s) there is an excess or shortage of in the labour market. However, this indicator generalises at the macro level, which means that it does not specify whether mismatch exists or not at the level of the individual. It also requires standard LFS data, which are generally available in the ETF partner countries, even though problems related to comparability may arise. Difficulties arising in this area are mainly associated with educational classifications which are not always consistent with ISCED levels.

3. Youth not in employment, education or training (NEETs) provides information on young people aged 15–24/29 who meet the following two conditions: first, they are not employed (i.e. they are unemployed or inactive); and second, they have not received any education or training in the four weeks preceding the survey. Data is expressed as a percentage of the total population of the same age group and gender, excluding the respondents who have not answered the question on participation in education and training. The indicator provides a measure of the youth population most at risk of being marginalised in terms of the labour market and underutilising their skills. This indicator also requires standard LFS data. The challenges here mainly lie in defining the variables for

[5] The results for Morocco are not comparable with those of the other participating countries and so are not discussed here.

[6] Unemployed persons comprise those aged 15 and over who were without work during the reference week; are currently available for work (were available for paid employment or self-employment before the end of the two weeks following the reference week); are actively seeking work, i.e. had taken specific steps in the four-week period ending with the reference week to seek paid employment/self-employment; or had found a job that would start at a later date (within a period of, at most, three months).

participation in training, which are not always consistent between countries.

4. Mismatch by occupation is based on comparing the numbers of people with a given education level (ISCED) working at an inappropriate skill level (measured by the ISCO) as a ratio of all workers within that ISCED level. The same process can be carried out for different education and ISCO levels, and, if the necessary data are available, it is also possible to compare the mismatch by occupation for different age groups[7]. This indicator requires data on employment by education level and occupation that are normally available in the LFS. The indicator provides information on employed people and how well their formal qualifications are utilised in the jobs they have. The method does not consider the population which is not employed due to mismatch.

5. Over-/under-education (based on the empirical method) can be used in cases where datasets do not include specific questions on over-education/over-skilling. It is a relatively simplistic measure and must be interpreted as a proxy. The empirical measure is a purely statistical one where the distribution of education is calculated for each occupation; over-education is defined as existing when the level of education is more than one standard deviation above the mean or the mode for the education level required for a given occupation. The education mean and/or mode for each occupation is thus assumed to be a match for that occupation. Data on the education levels and occupations of those in employment are needed for the implementation of the empirical method, and LFS or household surveys could provide such information. The method is simple to use but cannot be considered very robust as it applies a strict mathematical match between education levels and occupations.

6. Coefficient of variation by skills compares the distribution of skills within various groups (e.g. employed vs unemployed), and the difference of these skills distributions between the different groups is expressed in just one number which measures the overall extent of mismatch. For example, the skills possessed by employees can be compared to those of the unemployed: the higher the number, the greater the difference between the skills of employed workers and those of people seeking to enter the labour market. The extent to which the distributions vary can therefore be seen as a measure of the ineffectiveness of the matching process of

skills supply and demand in the labour market. This indicator is a suitable choice for obtaining an initial assessment of mismatch, however the direction of mismatch is not measured so it is not possible to state whether there is an oversupply of highly educated individuals compared to demand or if there are too few low-skilled people. To compensate for this, the indicator can be interpreted in tandem with the proportion of unemployed versus unemployed (see above). In order to calculate this indicator, the educational attainment of the population is required, together with that of the employed population measured by the same education level. Coefficients of variation of employed people can also be compared with the educational attainment of unemployed or inactive people.

7. Relative wages by educational level simply compares the wages for each education level over time, either relative to a benchmark wage or indexed compared to a base year. The strength of this indicator lies in its simplicity and intuitive interpretation: an education level that is seen to attract a higher income than that achieved by people with other levels of education can thus signify that this particular level of education is in greater demand in the labour market. A human capital wage regression approach might have to be taken to tease out specific effects that are due to institutional settings or sluggish adjustments of wages to demand and supply imbalances. Wage data typically come from labour force or household surveys and, due to the sensitive nature of the data, can be unreliable.

The findings in the seven partner countries (ETF, 2019a) revealed the key strengths and weaknesses of the various indicators presented in this article. It is therefore easy to see that, although the unemployment rate, coefficient of variation, proportion of unemployed to employed and NEETs indicators are somewhat simplistic measures, it is feasible to calculate them in most ETF partner countries; whereas theoretically stronger measures, such as worker self-assessment, systematic job evaluation or relative wage rates suffer from poor data availability. The calculation of the horizontal type of mismatch was found to be unfeasible from a cross-country perspective given the variations between the selected countries regarding the reflection of field of education in the Labour Force Surveys. More direct measures such as 'skill shortage vacancies', which measure the extent to which vacancies are not filled due to the lack of skills, qualifications or experience, can be found for specific economic sectors, but these require large expensive surveys and are only conducted in very few countries.

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[7]   The indicator calculated originated in OECD (2010), where educational and occupational mismatches were determined.

Other data sources for calculating skills mismatch indicators include self-assessment tools such as tracer studies, employers' surveys and other occupational/skills needs analyses. The indicators can be derived indirectly by asking about the required skill level for a particular position (e.g. occupation, job), and specifically about the competences one would need to have in order to be employed in that role. The measures derived from these tools are notable for their simplicity, as their interpretation is rather straightforward: skills mismatch occurs if there is a difference between the skill level a person possesses and the proficiency perceived to be necessary to obtain/hold a particular position. However, this simple comparison requires several assumptions. Depending on the type of survey, the specific wording of the question and the general set-up, a mismatch might be assumed when there is simply a bias towards certain types of answers. Also, employers tend to overemphasise a lack of skills and underestimate over-skilling. They might notice when their staff fall short of the required skills; however, it is much more difficult to spot when their staff have unused skills. They may also have a tendency to compare job applicants with the initial, 'idealised' job vacancy. All these effects may lead towards a bias in favour of a 'lack of skills' (ETF, 2019a).

It should also be noted that attaching specific skills requirements to jobs, especially if these are identified by aggregate occupations, is an oversimplification as any job requires its own distinctive bundle of skills. The actual skills to be used and the way in which the work is organised are often only determined once a match has been made and a specific person been hired. The standard LFS does not facilitate working in such a fine-grained manner since it does not provide sufficiently detailed information. More specialised surveys, such as the OECD Programme for International Assessment of Adult Competencies (PIAAC) or the Cedefop European Skills and Jobs Survey (ESJS), can attempt to bring together the distribution of people's skills and the tasks involved in particular jobs in order to understand these processes.

9.4 Skills mismatch in seven ETF partner countries: main findings

This section presents the main findings on the incidence, direction and size of the skills mismatch in the seven ETF partner countries. As a preparatory phase to the mismatch calculation, the ETF research team undertook a thorough check of the availability and feasibility of the required data in the selected countries. The aim was to identify the most reliable

and affordable solutions to the challenges of calculating skills mismatch indicators at the country level. Despite the existence of data for all countries, the feasibility checks revealed some shortcomings in terms of data availability but also regarding the impracticality of carrying out disaggregation by detailed dimensions, such as type of education programme, gender, sub-national levels (regions) or certain age groups[8]. Another important angle of the ETF analysis was the calculation of some indicators by programme orientation (i.e. vocational education and training (VET) versus non-VET programmes at ISCED levels 3–4). Such data analysis is highly relevant in the socio-economic context of the ETF partner countries, particularly where 'VET-oriented' economic branches are strong (mostly in transition countries) and generate a significant amount of labour demand[9]. It would also help in addressing the still widespread perceptions of VET programmes as second-choice educational opportunities. The main findings are summarised below.

- The unemployment rate remained very high: one in five of the active population in North Macedonia and 15% in Montenegro, while in the other selected countries, the rate is around 10% (except Moldova where it is about 3%)[10]. Joblessness is a particular problem for people who have not completed upper secondary education in Montenegro, North Macedonia and Serbia. While employment opportunities still exist for those with lower qualifications, labour market prospects for this group are declining – a trend that is common to many countries. Increasing skill requirements are likely to be reflected in a falling share of elementary occupations, rising proportions of high-skilled occupational groups such as professional and technical, and the need for higher educational attainment levels. The ordering of unemployment rates by skill level provides a clear indication that the unemployment rate decreases with

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[8]   The findings suggest that many ETF partner countries need to enhance their LFS and other relevant statistical investigations. While international comparability has been achieved in many cases, further efforts are recommended in order to expand the number of observations (i.e. increase the number of households included in the survey) and hence secure more fine-grained evidence on skills utilisation in the labour market.

[9]   ETF findings show that the employment prospects of VET graduates are different compared to their peers who graduated from general/academic secondary programmes. In certain cases, like Serbia, Montenegro and North Macedonia, the employment rate trends of VET recent graduates are catching up with those of tertiary graduates, who typically enjoy better employment prospects.

[10] In some countries data by age groups are unreliable due to the small number of observations.

increasing educational levels. This is by no means the case in all countries: while North Macedonia follows this pattern, the unemployment rates in Moldova, Georgia and Serbia seem to be fairly similar across education levels[11]. People with VET qualifications fare somewhat better than their non-VET-educated counterparts in Georgia and Moldova, but far worse in Egypt, Montenegro and Serbia[12]. Youth unemployment is also very high in the selected countries, affecting about half of the young people in North Macedonia and around one in three in Egypt, Montenegro, Serbia and Georgia[13]. Young people face more challenges than adults do in entering the labour market owing to their lack of work experience and the mismatch between the skills they have to offer and those required by employers.

- Proportions of unemployed versus employed (unemployed to employed ratios) provide a way to express the magnitude of the number of unemployed. The analysis can include age, gender or educational attainment level, and a lower number indicates fewer unemployed people relative to those in employment. The results range from 0.04 (Moldova) to 0.15 (Egypt), 0.19 (Georgia), 0.20 (Montenegro and Serbia) and 0.32 (North Macedonia). The ratio is similar for men and women in Serbia, while it is much higher for women in Egypt and much lower in the other countries. Such findings may indicate women's vulnerabilities in the labour market in terms of the potential barriers to accessing employment, skills development and/or relevant education.

- Youth not in employment, education or training (NEETs). Evidence from the ETF and other sources (see Section 9.2 above) shows that young people seem to be most exposed to mismatch in the transition from school to work. The share of young people not in employment, education or training is most revealing in highlighting the precarious status of first-time jobseekers. Although receding in some of the

seven countries, the incidence of NEETs ranges from 15% in Serbia to 27% in Egypt, Georgia and Morocco. Young girls are typically over-represented in this group, and this is linked to several factors, such as socio-cultural norms, less favourable working environments and family duties. ETF evidence shows that this pattern is most pronounced in the South Eastern Mediterranean countries, where the female NEET rate is sometimes double that of males (ETF, 2019b). NEETs are at higher risk of being socially and economically excluded and so are more likely to become vulnerable in the long term. However, the NEETs category contains a variety of sub-groups, some of which are vulnerable and some not. ETF evidence (2015) shows that some factors are more important than others as determinants of NEET status. The high incidence of NEETs in a country is often related to such factors as lower educational attainment, gender, poorer employability as a result of skill gaps, and socio-economic background.

- Mismatch by occupation was expressed as the degree to which persons are employed in occupations below (not requiring) their level of education for two major groups of workers: those with tertiary attainment (ISCED levels 5–8) and those with medium-level attainment (ISCED levels 3–4). Those holding an upper secondary diploma (ISCED levels 3–4) are considered mismatched (over-qualified) if they work in elementary occupations (ISCO major group 9); also mismatched are those holding a tertiary degree (ISCED levels 5–8) who are working in semi-skilled occupations (ISCO major groups 4–9). The percentage of workers with upper and post-secondary education working in elementary occupations, ranges from around 7% in Serbia and Montenegro, to approximately 10% in Georgia and Egypt and about 14% in North Macedonia and Moldova. In most countries with data available (Egypt, Georgia, Montenegro and North Macedonia), women are more likely to be mismatched than men.
Conversely, in the case of workers with tertiary education employed in semi-skilled occupations, the rates of occupational mismatch are much higher, ranging from around 14% in Montenegro and 18.7% in Egypt, to 21.7% in North Macedonia and Moldova, 24% in Serbia and 36% in Georgia. In most countries where the relevant data are available (Egypt, Georgia, Montenegro and North Macedonia), men are more likely to be mismatched than women.
The inability of these countries' economies to create high-end jobs quickly enough to meet the oversupply of tertiary graduates partially explains the higher incidence of occupational mismatch

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[11] These outcomes are likely to have a multitude of underlying reasons, for example intermediate and higher education graduates do not possess the skills that are required in the labour market or there are too many graduates for which there is a lack of demand.

[12] In some countries one group (either VET or non-VET) can be rather small and heterogeneous.

[13] Youth unemployment rates have traditionally been higher than those of other age groups, and there are clearly some strong determinants here. Youth unemployment is more responsive than adult unemployment to the business cycle. This is because young people are more concentrated in certain economic sectors and a disproportionate number hold part-time jobs and temporary contracts. As such, they are also more affected by periods of economic crisis and are often among the first to lose their jobs.

for these graduates. Consequently, this could lead to an underutilisation of human capital and an increase in migration and the phenomenon of brain-drain. The high incidence of occupational mismatch leads to the precarious transition of school leavers and graduates into the labour market. Many young people choose to take up jobs below their level of education/qualification, hoping to gain work experience. Whereas this could be a temporary solution, it should be noted that a mismatched job will likely come with a wage penalty and skills depreciation[14].

- Over- and under-education rates were also calculated by employing the empirical method in which the distribution of education is calculated for each group of occupations; over-education was defined as existing when the level of education is more than one standard deviation above the mean for the education level required for a given occupation. ETF findings shows that, in the selected countries, over-education can be found predominantly among the elementary and intermediate occupations. Over-education can be seen across all countries among service and sales workers, in agricultural occupations and, of course, in elementary occupations. In some occupations more than a quarter of the workers are considered over-qualified. Conversely, under-education can be perceived among clerks and also technicians and associate professionals. It is less likely to occur in occupations where there are mandated qualification requirements (e.g. regulated professions such as nurses, doctors, accountants.)

- Relative wages produced a mixed outcome and no robust conclusions could be drawn with regard to the selected countries. While all the countries show that higher levels of education results in higher levels of income, wage developments that show a shift in supply versus demand imbalances fail to reveal a very clear picture. The highest annualised wage growth rates can be found at almost any educational level. In Georgia, wages for those with the lowest educational levels exhibit the strongest

annual growth; Egypt shows the same pattern but with little difference observed between all levels and the ordering has shifted over the years under scrutiny. In Moldova people with VET attainment experienced the highest change in annual wages while in Serbia this was the case for people with the least education, again without sizeable differences across educational levels. A human capital wage regression approach could be used to further explain these patterns.

It is clear from the examples given here that it is possible to measure skills mismatches in the ETF partner countries using the indicators presented above. The main conclusion to be drawn is that no single indicator should be used exclusively. Each indicator provides insights into different aspects of the complex matter of skills mismatch, and, thus, using an array of indicators will potentially result in highlighting the widest possible range of elements. ETF partner countries should pursue several avenues simultaneously to explore the data to the fullest extent. More data can be made available in some cases, which would allow for further calculations to be made. Using the experience gained from studying the seven countries, the calculation of some indicators is particularly recommended over others. These are unemployment rates, NEETs, and coefficient of variation by skills, although occupational mismatch could also be included on this list. The best results are likely to come from calculating mismatch through as many different methodologies as possible, and then comparing the results. One desirable option would be to combine these quantitative methods with qualitative methods, such as structured interviews, panel discussions and focus groups. One of the key lessons learned is that data alone does not provide a complete picture. Without national context and country-specific insights into the potential reasons for specific outcomes, the interpretation of the indicators is relatively meaningless. The indicators merely provide the first signs of an issue requiring attention. Working alongside national experts in collecting but also interpreting findings has been crucial for the ETF.

Some determinants of skills mismatch: gender, age, educational attainment
All indicators for which gender disaggregation was feasible reflect differences in the incidence of mismatch between men and women, underlying the need to make the available evidence and subsequent analysis, as well as policy responses, even more gender sensitive. Various factors contribute to women's over-exposure to inactivity

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[14] This measurement provides a glimpse into the inefficiencies involved in not fully exploiting the potential of human capital and is more evident in occupational mismatch for semi-skilled jobs. This is worrying as typically young graduates face more difficulties in finding a matched job within the first years of looking for a job, and therefore the vertical mismatch is expected to be higher among younger workers. Although the indicator was calculated for the total employed population without a disaggregation by age sub-groups due to resource limitations, the results below suggest that the mismatched situation tends to persist for longer in the professional careers of many workers from these seven countries.

and unemployment in the ETF partner countries, ranging from traditional attitudes towards women's role in society and family contexts and insufficient access to quality childcare services, to stereotypes in the workplace and fewer career opportunities leading to weak labour market attachment among women.

Age also matters in skills mismatch. Unemployment to employment ratios are three times higher for the young than for the prime-age group (aged 25–54) in Serbia and North Macedonia and about twice as high in Georgia, Moldova and Montenegro, but seven times higher in Egypt. This gives an indication of the much greater effect of unemployment on young people compared to prime-age workers. If these indicators are considered to be stable, they would hint at a problem in terms of young people making the transition to work. High unemployment levels and limited opportunities in the labour market force medium- and especially higher-educated individuals to accept positions requiring relatively low levels of skills. During their (first) transition into the labour market, young people often gain practical experience by accepting such jobs. Together with low labour mobility, this leads to a higher level of observed mismatch in the labour market.

The composition of the workforce was observed as constantly changing in all seven countries, with the general trend in most of them moving towards raising the educational attainment levels of the workforce. However, the low-skilled population remains sizeable in some countries; three out of four adults in Morocco and about half of the adult population in Egypt have attained at most the lower secondary level of education (in most countries this usually corresponds to compulsory education)[15]. Better educated younger generations however seem to be a common trend for these seven countries, as most of them have managed to address the challenges of school disengagement (dropout) and early school leaving. Nevertheless, many countries are still experiencing the legacy of low attainment among prime-age and older cohorts of the population. Low qualification levels remain widespread in rural and underdeveloped areas. Understanding the overall education attainment of the population is crucial for the assessment of mismatch incidence, but the quality and completeness of the available data on this subject somewhat limits a straightforward comparison of results across countries.

Variations in employment and unemployment related to educational attainment signal the possible causes of labour market imbalances that are seen in either a decrease in labour demand or a misalignment between the skills sets of the workforce, in particular jobseekers, and the requirements of the available job opportunities. Analysis of such differentials in education level within the working-age population is important for assessing the potential for skills-based economic growth or employment promotion strategies. According to the ETF mismatch analysis (2019a), when compared to the overall population, the employed cohort exhibit greater differences across educational levels, implying that higher levels of attainment lead to an increased probability of being employed in Egypt, North Macedonia, Montenegro and, to a lesser extent, in Serbia, Moldova and Georgia. Less pronounced differentials between the educational profile of those in employment and the overall working-age population imply that skills levels do not play a significant role in the likelihood of finding work, and may in fact signal a problem in terms of the availability of job opportunities (low aggregate demand).

9.5 Skills mismatch and future skill needs

Beyond the mere identification of 'what lies ahead' in terms of the demand for qualifications, skills and competences, one should also look at the other side of the coin to assess the real potential of individuals, companies and institutions to adjust to the emerging labour market changes. High and persistent incidences of mismatch highlight the difficulties that governments and social partners encounter when dealing with labour market imbalances.

As discussed in the previous sections, the incidence of skills mismatch may signal various types of imbalances in the labour market. For example, the same indicator – over-education among workers with tertiary degrees – can signal an oversupply of workers with a university-level education or a shortage in labour demand for such employees. Similarly, mismatch characteristics can lead to various detrimental impacts at different levels, for instance: job dissatisfaction sparked by individuals' educational attainments and expectations; or losses for companies forced to invest in skills development or updating for (newly) hired workers; or inefficiencies at the sector level or across the entire economy due to skills shortages.

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15 However, the ETF analysis (2019a) found that in Egypt the educational attainment of around one fifth of the surveyed population (LFS) was unknown.

Given the variety of manifestations of skills mismatch, the process of making clear and timely assessments of the policy implications and identifying appropriate responses is significantly constrained. Accompanying the calculation and interpretation of mismatch indicators such as over-education, the coefficient of variation by skills or unemployment to employment ratios and the incidence of unemployment and inactivity, the ETF argues for a multi-dimensional identification of mismatch occurrence, involving a thorough, insightful analysis of labour market and education contexts, trends over time, and levels of education attainment (including their distribution across the population cohorts in a given country), as well as various institutional aspects (e.g. labour regulations and other factors influencing labour market transitions, such as workforce reallocation or regional disparities).

As explained in the methodology section, the ETF opted mainly for LFS-based indicators. This ensures the solidity of the findings, based as they are on country-owned data that have a high degree of validity and are trusted internationally. This is important as the results of mismatch calculations are often challenging and result in limited acceptance, particularly among policy makers in the education field. Both EU members and neighbouring countries for which data are available are facing a high prevalence of over-education, with one in four, or even one in three, employees with tertiary education working in jobs below their level of qualification. A strict correlation between a country's economic performance, as reflected in growth dynamics or unemployment or inactivity levels, and the presence of skills mismatches (both vertical and horizontal) is not straightforward and may oversimplify the findings. Nevertheless, most of the EU Member States from the Southern, Central and Eastern European regions show a higher incidence of skills mismatch (Eurostat, 2014–18 skills mismatch calculation), as in the case of the ETF partner countries selected for this mismatch assessment.

Such findings reinforce the idea that a country's low economic performance compels its workers to accept jobs that are not fully matched to their level or field of education. However, countries like Sweden and Austria, with a reasonably good track record in economic performance and low levels of joblessness, also exhibit relatively high incidences of vertical and horizontal mismatch. Therefore, the relationships between economic performance (growth, jobs availability, etc.) and mismatch occurrence should be carefully investigated. A multi-dimensional analysis of labour market conditions and opportunities and changes in occupations and qualifications or sectoral re-adjustments,

among other factors, is crucial to delineate clearly the causes of misalignment between jobs and education (fields or levels), as well as the conditions underlying skill mismatches and what can be done to address them, particularly when the incidence trends remain almost unchanged for years.

This also hints at the need to foster stronger skills identification and anticipation governance systems from a multi-level perspective in order to enable the timely recognition and interpretation of labour market trends and future skills needs. Skills mismatches signal labour market inefficiencies and can guide researchers and policy makers in the identification of emerging or persistent imbalances in supply and demand at the level of sectors and education fields.

Economic, sectoral and technological transformations are major triggers of such imbalances, in response to which, mismatch evaluation should be included in the overall effort to identify changing demand in the labour market, predict future needs and establish more effective processes for skills analysis.

This is particularly important for certain education systems, such as VET, which are strongly orientated towards specific occupations or sectors. Certain occupations or job clusters evolve faster than others, and the adaptation of the educational offer to labour market needs is a lengthy and complex process, involving multiple stakeholders and steps (identifying job changes and profiles; curricula development or updating; teacher training and adapting the school/training infrastructure). The regular gathering of data on skills mismatch occurrence can act as an early warning with respect to emerging inefficiencies as well as providing information to VET decision makers, social partners engaged in skills councils or committees, and schools or training providers. Stakeholders can then act swiftly with targeted skills analyses and new or updated education and training provision.

9.6 Concluding remarks

The term skills mismatch is very broad and can refer to a variety of concepts, including vertical mismatch, horizontal mismatch, skill gaps, skill shortages and skill obsolescence. As discussed in the article, skills mismatch is a complex phenomenon, which is manifested in different types and dimensions of labour market conditions. The process of measuring and understanding the scale and interrelatedness of the different forms of skills mismatch requires a combination of indicators and analysis of results from different methods.

As discussed in the second and third sections of the article, several methodological issues related to the use of mismatch indicators can be listed, while the main criterion to be considered when proposing new indicators is data availability. It is important to use international standardised classifications and compliance with the internationally agreed definitions should be observed. Ease of interpretation should also be considered in the choice of indicators.

Mismatch analysis should be well contextualised and consider the underlying conditions specific to transition and developing countries. Policy recommendations on skills mismatch should be always precise, stating the exact type of mismatch in question and how the policy priority is expected to address it.

Multiple angles and therefore indicators should be employed in the assessment of skills mismatch incidence, as various indicators point to different triggers and underlying conditions. Exclusive focus on one particular mismatch indicator, for example vertical or horizontal misalignment between job and level or field of education, may result in a misleading or incomplete interpretation of the facts.

The relatively high level of over-education revealed in this analysis, particularly among tertiary educated employees, is not completely surprising since such workers are typically more exposed to (vertical) mismatch. Nevertheless, the high percentages (over 20%) found in most countries in the study indicate that university graduation does not necessarily lead to a matched integration within the labour market and can indeed signal a waste of human capital. Explanatory factors are many and country-specific analyses are necessary to identify the exact causes and most effective solutions to prevent or counteract such imbalances. What emerges clearly is that education systems are only partly responsible for generating such imbalances through insufficiently forward-looking enrolment policies, poor quality and irrelevant educational programmes, or failures in addressing social inclusiveness goals. Effective matching services and programmes for gaining work experience during the transition phase from school to work are also essential. In the seven countries included in the mismatch research, as in many other ETF partner countries, such services are under-resourced and only a fraction of young graduates enjoy these types of opportunities.

Almost all seven countries' economies face the challenge of low-quality jobs, including the issue of informality. This must be factored in when designing policy responses as it significantly influences people's choice of job/career. Many workers may prefer a better paid job or a more secure workplace over a position that matches their studies. As countries move towards more technology- and innovation-based economic activities, the demand for higher and more sophisticated skills sets will increase (although accurate assessments are currently somewhat constrained by the economic and social impact of the Covid-19 pandemic).

Nevertheless, skills development actions should be closely correlated with the economic drive towards innovation in order to avoid, as far as possible, the human capital wastage signalled by skills mismatch.

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ARTICLE 10
AUTOMATION AND WORK CHANGING SKILLS REQUIREMENTS: THE RETAIL BANKING SECTOR IN LEBANON

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This case study explores the changes in job content and in the education and skill requirements for entry-level jobs in the retail banking sector in Lebanon. The research draws on 47 in-depth interviews with senior managers, human resources (HR) directors and retail bank employees, conducted in nine major banks in Lebanon between January 2019 and February 2020. The interviews addressed the themes of automation, recruitment and the shift in required education levels and workforce skills. In interviewing both employers and employees, this article seeks to provide a real-life account of the ways in which automation has changed the nature of work as well as the education and skill requirements at the micro-level, as experienced first-hand by retail bank employees. This article thus fills a research gap, as case studies analysing education and skills shifts at the sectoral level are scarce in the literature, particularly for Lebanon.

10.1 Introduction

The number of higher educational institutions (HEIs) in Lebanon has more than doubled in recent decades from fewer than 20 by the end of the Civil War in 1990 to 49 licensed private HEIs in 2020. The expansion in enrolment rates has been led by private institutions, which include 36 private universities and 12 university colleges, technical institutes and theological schools. The Lebanese University is the only public university in Lebanon, absorbing over a third of the total tertiary student enrolments (38%) at all levels (Bachelor's, Master's and doctorate programmes) in 2017/18 (see Table 10.1)[2].

The expansion in tertiary enrolment rates has been led by private universities, with 18 HEIs established just since the turn of the Millennium. Whereas student enrolments at the Lebanese University increased by just 7% in the past decade,

the number of students enrolled in private higher education institutions increased by 41% (see Figure 10.1) over the same period[3]

Today, approximately 21% of the population in Lebanon holds at least a university degree. Business is one of the most popular majors among university graduates, with over a quarter (27.8%) specialising in business, administration or law in 2017/18 (CERD, 2018)[4]. The banking sector is one of the main industries targeted by these university graduates.

The increase in the share of university graduates in the labour market, however, has not been met with a similar expansion in labour market demand for high skills, leading to an oversupply of skilled graduates. The youth (15–24) unemployment rate among university graduates in Lebanon (31.5%) is almost triple the general unemployment rate (11.4%) (CAS and ILO, 2019). Furthermore, it is estimated that approximately 44% of Lebanon's tertiary-educated population has emigrated, suggesting a significant brain drain (World Bank, 2016).

3   Between 2007/08 and 2017/18 using CERD data.
4   A total of 58 455 private and public university graduates graduated with an undergraduate or postgraduate degree in these subjects out of a total of 210 720 graduates in 2017/18.

Table 10.1. Student enrolments by university type and academic degree, 2017/18

UNIVERSITY TYPE	UNIVERSITY DIPLOMA[a]	BACHELOR'S[b]	MASTER'S[c]	DOCTORATE[d]	TOTAL NUMBER
Lebanese University	0	72 850	5 043	1 467	79 360
Private universities, university colleges, institutes and theological schools	219	110 175	18 391	2 575	131 360
Total – all HEIs	219	183 025	23 434	4 042	210 720

Notes: [a] Equivalent to International Standard Classification of Education (ISCED 2011) level 5; [b] Equivalent to ISCED 2011 level 6; [c] Equivalent to ISCED 2011 level 7; [d] Equivalent to ISCED 2011 level 8.

Source: Author's elaboration, based on Centre for Educational Research and Development (CERD) Statistics Bulletin 2017/18.

Figure 10.1. Student enrolments in Lebanese universities by university type, 2006–18
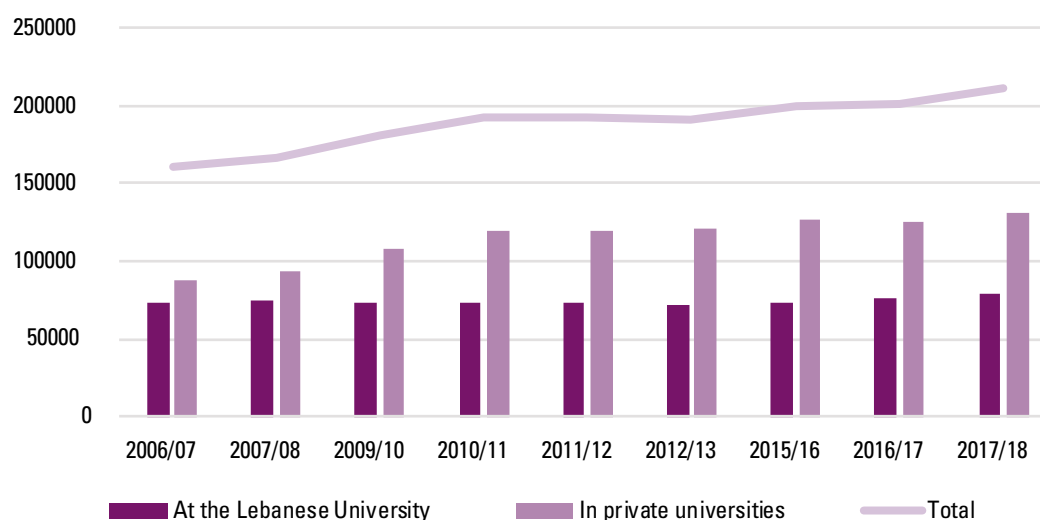
Source: Author's elaboration, based on CERD Statistics Bulletin 2017/18.

Young people who remain in Lebanon struggle to find jobs that match their skills, with almost a third of those who are employed estimated to be overeducated and in occupations that do not require their educational qualifications to get the job (CAS, 2019). The youth unemployment rate (23.3%) is also more than double the general unemployment rate, with approximately half of unemployed young people spending over a year searching for work. Approximately a quarter of youth (22%) are not in employment, education or training (NEET) (CAS and ILO, 2019). Total labour force participation rates are also low (48.8%), particularly among women (29.3%).

The private sector accounts for 86% of those in employment, with more than two-thirds of the active working-age population occupied in the service sector (CAS and ILO, 2019). The banking industry employed an estimated 26 005 people in 2017, with women comprising approximately 47.8% of bank employees (ABL, 2017). Overall, the banking sector employs approximately 1.6% of the total employed population in Lebanon[5].

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[5] In 2018–19, approximately 1 590 400 people were in employment according to the most recent Labour Force and Household Living Conditions Survey. If we assume the same number of employees in 2019 as in 2017 (given the lack of data), banking employees represent approximately 1.6% of the total employed population.

The banking sector has been described as 'the durable heart of Lebanon's embattled economy' (Russell-Walling, 2015), with 65 banks[6] currently operating in Lebanon and a total of 1 086 branches spread across the country (ABL, 2017). The concentration of branches per 100 000 inhabitants is almost double the global average of 12.2, reaching 23.8 branches per 100 000 adults in 2017 (World Bank, 2018).

Today the major Lebanese banks all require a minimum of a Bachelor's degree for all new entry-level jobs in their branch offices, with over two-thirds of all banking staff (78%) holding at least a Bachelor's[7] degree. This shift in preference towards hiring university graduates began in the late 1990s and has proliferated in recent years, with the share of bank employees holding at least a Bachelor's degree increasing from 70% in 2013 to 78.8% by the end of 2017. Approximately 12.7% of the remaining bank employees hold a Baccalaureate degree or its equivalent, while only 8.5% of bank employees have not reached the baccalaureate level.

This paper sheds light on some of the key factors underpinning the decision to upgrade educational requirements for entry-level jobs in retail bank branches, leading to the gradual 'graduatisation' of these positions, with graduates now holding the majority of historically non-graduate occupations (Tholen, 2016). Drivers for the graduatisation of the sector include changes in the content of the 'teller' job due to automation, the introduction of more complex regulatory frameworks, and the rapid expansion of higher education in Lebanon. Employers' perceptions of the quality of higher education has also shaped employer preferences for university graduates for all entry-level positions in bank branches.

The article is structured as follows. The next section provides a brief discussion of the literature on graduate recruitment and skill shifts in the retail banking industry globally. Section 10.3 describes the research methodology used in this study. Section 10.4 looks at the transformation of entry-level jobs in retail banking in Lebanon, describing the transition towards e-banking, changes in education supply and skills demand, and graduate recruitment trends. The final section discusses the future of retail banking.

10.2 Literature review

Automation has impacted the job content of many occupations and changed the nature of work across sectors. Whereas some jobs have been eliminated entirely, others have been restructured, leading to the loss of certain tasks without eradicating the job itself (Autor et al., 2002; Bessen, 2015). In the retail banking industry, with the introduction of automated teller machines, tellers have been freed from a number of routine tasks, which have instead been standardised and taken over by artificial intelligence (AI) systems. Instead of the entire job being automated and consequently eliminated, however, automation has led to a shift in workers' tasks from processing routine bank transactions to managing customer relations and the sale of financial products (Autor et al., 2002; Bessen, 2015). The skills needs of bank staff have consequently changed from clerical proficiency to customer service and sales expertise (Frank et al., 2019), with retail banking witnessing a global shift towards a 'sales-oriented culture' (Knights and McCabe, 1998; Frank et al., 2014).

This shift towards a sales-dominated culture has required different types of competencies, with interpersonal and sales skills becoming crucial for success in the branches. The International Standard Classification of Occupations (ISCO) classifies the teller occupation as a non-graduate job and does not associate the skills level required for this job with complex tasks calling for a university degree. A high-school diploma or the General Certificate of Secondary Education (GCSE) is also generally the education level required in major economies for the teller position. In Germany, for example, only a quarter of banking employees are university graduates, with the majority (62%) being vocational education and training graduates[8] (Hackel, 2014). In other countries, however, like Spain, where the share of university graduates exceeds the labour market demand for high-level skills, the teller position is today a graduate occupation requiring a successful applicant to have at least a university degree in a relevant subject to get the job (Osseiran, 2020). Commonly required soft skills for the position of bank clerk or teller include strong communication skills, professionalism and proficiency in the areas of customer service and sales (Frank et al., 2014).

The overall number of tellers would have been expected to decline globally with automation. In countries like the US, however, the introduction of automated teller machines and the subsequent elimination of certain tasks did not lead to a

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[6]   Comprising 49 commercial and 16 investment banks.
[7]   This requires at least three to four years of university education, equivalent to ISCED 2011 level 6 (665).

[8]   With the relevant training specialisation title of 'bank clerk'.

decrease in the number of tellers in the retail banking industry. Instead, paradoxically, the number of tellers increased between 1988 and 2004, as American retail banks responded to a reduction in the costs of running a branch by increasing the overall number of branches to widen their market share (Bessen, 2015). In other countries, like Spain (Osseiran, 2020), the teller and customer service function have increasingly merged, with the same branch employee handling both the teller and customer service role, including the sale of financial products and services.

In addition to rapid advancements in technology, entry-level education and skills requirements in the retail banking industry have also been influenced by the expansion of higher education and employers' perceptions of its quality, with research showing that employers' perceptions of the quality of education influences the employment prospects of graduates (Walker and Fongwa, 2017). Evidence from the UK (Brown and Hesketh, 2004; Keep and Mayhew, 1996), for example, suggests a link between over-education, defined as having a higher level of education than that required for a particular job, and the perception among employers that the quality of education provision has been compromised with the expansion of higher education. Brown and Hesketh (2004) point to universities 'dumbing down'[9] their degrees in order to attract growing numbers of less able students (p. 218). This, in turn, has prompted firms to respond by increasing their educational requirements beyond the needs of the job itself, leading to poor graduate 'skill utilisation' (Warhurst and Findlay, 2012), with graduates unable to fully utilise their skills in the workplace. This was confirmed for entry-level positions in a number of retail banks in Spain, where employers conceded that even though graduate skills were not required to carry out these roles, the oversupply of graduates with at least a Bachelor's degree, relative to the number of entry-level jobs available, created a demand for university qualifications (Osseiran, 2020).

Some employers responded to higher education expansion by segmenting universities and adopting different recruitment strategies for graduates. In the financial services sector in the UK, for example, employers adopted a 'multi-tier recruitment strategy', whereby some university graduates were recruited for mid-level clerical jobs that were not traditionally associated with a university education, and others for 'mainstream graduate entry programmes' that offered substantially

different starting salaries and career prospects (Mason, 1996). This led to a variety of graduate labour market outcomes, depending on the entry-level starting point of graduates in the job market, with higher education and labour market outcomes serving as 'two interlocking systems of economic stratification' (Rivera, 2015, p. 274). Similarly, in the US, even though the competition for high-skilled jobs in prestigious elite professional services[10] firms had been formalised and positions were technically open to all graduates, the 'signals elite gatekeepers [employers] value[d]' effectively just served to reproduce the same elite (ibid, p. 265).

10.3 Research design

Economists have predominantly used wage equations to determine the skill content of jobs, taking remuneration as a proxy for skill level. Quantitative analysis alone, however, is not sufficiently informative as to whether in assuming traditionally non-graduate jobs, the skills of university graduates are in fact underutilised in the workplace (Mason, 1996). To this end, this research adopts the sectoral case study approach, in the belief that an analysis using qualitative methods allows for a more in-depth investigation of the changing content and skills requirements of specific jobs over time.

The study involved site visits to nine retail banks in Lebanon, during which a total of 47 semi-structured interviews were carried out between January 2019 and February 2020. These included in-depth interviews with 18 senior managers, 6 branch managers and assistant branch managers and 23 young bank employees working in the branches or in the head office. On average, each interview lasted between 60 and 90 minutes. Interviews were conducted in English or Arabic, with the two languages sometimes mixed to ease fluency. The coding was carried out on the English transcription of the interviews using HyperResearch.

Interviews with senior managers covered graduate recruitment and changes in educational and skill requirements for entry-level jobs. The interviews targeted senior executives and human resource directors, as the latter were also key players in setting HR strategies and recruitment practices in their respective banks. At least two senior managers were interviewed in each bank to cross-check information on recruitment policies and strategies within the same organisation.

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[9] The deliberate oversimplification of intellectual content in education.

[10] Prestigious investment banks, law firms and management consulting firms.

Semi-structured interviews with entry-level employees at the head offices and employees in the branches were also carried out. Interviews with bank employees focused on job functions and direct self-reports of over-education, defined as having a higher level of education than required to get the job, and over-skilling, defined as having a higher level of skills than required to execute the job. Except for senior managers, the vast majority of bank employees interviewed were millennials (born between 1981 and 1996), between the ages of 24 and 35, with just over half (51%) being women. All employees interviewed were university graduates, with seven also holding a Master's degree.

In choosing the sample, this study targeted the 14 alpha banks in Lebanon – the largest retail banks in terms of assets, which together held 87% of the country's banking assets in September 2017. Each alpha bank holds deposits of at least USD 2 billion[11]. In selecting which banks to approach, multiple-case sampling was used, which involves purposively deciding which organisations to interview (Miles et al., 2013). Accordingly, all 14 alpha banks were invited to participate, out of which 9 banks agreed to take part.

10.4 Results of the research

10.4.1 Digitalisation and the evolution of tasks and skills requirements

Digitalisation has already begun to transform the retail banking landscape in Lebanon. Retail banks in the country provide digital banking services including online and mobile banking, giving customers multiple channels through which to complete their financial transactions outside the branch. Clients can also use automated teller machines to make deposits, withdrawals and transfers without having to physically visit a branch. More recently, Bank Audi was the first bank in Lebanon to launch interactive teller machines, which allow customers to carry out banking services themselves, consulting remote tellers via audio-video links. In some branches, like Bank Audi's NOVO, clients can open new bank accounts and apply for various financial products via interactive teller machines. Some leading banks in Lebanon, including Audi, Bankmed, BLOM,

Byblos and Fransabank, have also initiated customer relationship management systems and tools. Other banks are working to develop their customer relationship management systems to allow for the central processing of client data, facilitating the targeted marketing of financial products and risk management.

Despite these rapid advancements in technology, however, Lebanese consumers, and particularly those in the baby boomer generation (born between 1946 and 1964) and Generation X (born between 1965 and 1980), continue to prefer the brick-and-mortar in-person experience. Whereas the younger generation was 'born with tablets', the older generation 'doesn't trust the machine', to quote one senior banking manager interviewed (B6[12]). As a result, the move towards digitisation has been met with cultural resistance, with the older generation preferring face-to-face interactions. 'It's not in our culture not to talk,' observed one HR executive (B9), who estimated that not more than 10% of the population used e-banking. As a consequence, banks are pushing back and providing financial incentives for clients to opt for self-service facilities, making e-services cheaper than executing the same operations at the branches.

In addition to cultural resistance, other legal impediments have hindered the transition to e-banking. E-signatures, for example, are still not accepted for official banking documents, even though the Lebanese Parliament adopted a new e-transactions and data protection law (Law No 81/2018), which came into effect in January 2019. The law addressed e-banking, making e-signatures and e-documents as legal as their paper-based counterparts. An implementing decree was then required from the Central Bank for the legal recognition of e-signatures relating to e-payments and transfers. To date, however, the Central Bank has not yet issued this decree. As a result, banks today only accept blue ink signatures, which presents a considerable hindrance to e-banking.

Complete digitalisation is, therefore, not yet the reality in Lebanon, with paperwork remaining essential for completing banking transactions. Technology has made the cash and non-cash operations of tellers 'easier, faster and more efficient', according to one senior bank manager (B7). However, given the cultural and legal

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[11] A formal letter was sent by email to all alpha banks outlining the rationale for the project, providing the identity of the researcher and supervisors and assuring the respondents of anonymity and confidentiality. An information sheet was also annexed to the letter, explaining exactly the information required from participants and the reasons they were chosen to participate in this project.

[12] Each of the nine banks interviewed is identified through a unique identifier, in line with Institutional Review Board requirements, so that they are not identifiable in published documents.

impediments to digitalisation, the number of tellers in Lebanese banks has not begun to decrease in the branches, with tellers continuing to process basic banking operations (B2, B5, B8, B9). This is because 'the load in Lebanon is still in the front office not in the back office', as observed by one bank manager (B9), who estimated that tellers at his bank still handled 75% of banking operations.

10.4.2 Automation: a substitute for or a complement to the teller job?
The teller is a front-line employee, and the first staff member customers interact with. The teller in Lebanese banks today receives customers, serves as a cashier and processes banking transactions. These transactions include cashing cheques, processing deposits and withdrawals, and making loan payments and money transfers. Tellers also promote the bank's financial products and services.

In the past a university degree was not a requirement for the position of teller, with several Lebanese banks still having an older generation of tellers or main tellers who learnt their duties on the job. A high-school diploma was generally the level of education demanded to fulfil this role (see Table 10.2).

The vast majority of Lebanese retail banks today, however, require a university degree in business administration, finance, economics or equivalent to consider a candidate for the teller position. Some banks began to require a university degree for the teller post in the last six years and others since the late 1990s, with the transition from a paper-based to a computer-based system. This led to the effective 'closure' of this clerical support occupation to non-graduates (Tholen, 2016), even though it had been traditionally considered a non-graduate job following ISCO definitions (see Table 10.2).

Before automation, the teller spent the bulk of their time completing clerical tasks, where attention to detail and accuracy was crucial for the successful execution of the job. However, given the rapid advancements in technology and the automation of many routine administrative jobs, retail banks have been shifting their focus to providing financial advisory services. This move from handling routine banking transactions to promoting financial products and services has changed the skillset required from branch employees, including the entry-level positions of teller and junior customer service agent/personal banker.

Given the shift at the branch level towards sales, all employers spoke about the growing importance of soft skills, particularly presentation, prospecting or cross-selling, negotiation and communication skills.

Job descriptions for the teller position confirmed the growing importance of soft skills, particularly in terms of customer focus, communication skills, self-management, negotiation and professionalism. Several employers (B1, B6, B7) described a 'good teller' as one who was able to cross-sell financial products as they were processing a transaction, before referring the client to customer services for more information. 'We do more selling and less operations', which 'will require a different set of skills, with more focus on soft skills', said one senior bank manager (B3).

To be eligible for the teller position, candidates must have at least a Bachelor's degree in business, finance, economics or equivalent, and proficiency in at least one foreign language (English and/or French). Banks offered initial training that often included rotation across the branches to better understand bank products and services, as well as the requirements and regulations of the Central Bank. In addition to efficiency indicators, including the number of clients served and percentage of inquiries resolved within set timeframes, customer service satisfaction was one of the key measures used in teller staff appraisals.

Several Lebanese banks, such as the Bank of Beirut, Credit Libanais, and Bank Audi had their own in-house training academies or schools for tellers, providing both technical and soft skills coaching. Other banks had training units. The training offered encompassed branch operations, retail banking products and services, credit, risk management and compliance, anti-money laundering measures, Lebanese financial regulations and banking law, languages and IT. Soft skills training was also provided with regard to leadership and organisational behaviour, sales, business development skills and customer service[13]. All banks interviewed also offered training on the bank's financial products and services, with employees undergoing assessment tests upon completion of each course. Banking employees also had to pass the Central Bank examinations, including those on Lebanese financial regulations and banking ethics.

Given the training provided to every newcomer, the majority of bank employees interviewed believed that the teller job did not require their university skills. One personal banker (B4) described herself as a 'sales representative', arguing that 'you don't need to study banking to come and sell'. Another teller (B8) described his functions as precisely those of an automated teller machine, with the human 'added value' being communication and sales.

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[13] www.bankofbeirut.com/en/Careers

Table 10.2. Entry-level occupations at the branch level and skill levels required

POSITION	ISCO MAJOR GROUP	ISCO SUB-MAJOR, MINOR AND UNIT GROUPS	TASKS	EDUCATION REQUIRED TO DO THE JOB[a]
Bank teller	Group 4. Clerical support workers	Customer service clerks (42) Tellers, money collectors and related clerks (421) Bank tellers and related clerks (4211)	Processing cash deposits, cheques and other payments and banking transactions and crediting or debiting clients' accounts and making money transfers	ISCO skill level 2[b] Medium-skilled with ISCED 2 or 3
Credit and loans officers	Group 3. Technicians and associate professionals	Business and administration associate professionals (33) Financial and mathematical associate professionals (331) Credit and loans officers (3312)	Evaluating credit and loan applications and recommending decisions regarding approval or disapproval to management	ISCO skill level 3[c] High-skilled requiring ISCED 5[d]
Branch manager	Group 1. Managers	Production and specialised services (13) Professional service managers (134) Financial and insurance services branch managers (1346)	Directing/ managing the activities of staff in a branch	ISCO skill level 4[e] High-skilled requiring ISCED 6–8

Notes: [a] ISCO has four skill levels as measured by the nature of work performed related to typical tasks and duties, the level of formal education required to perform tasks, and the amount of informal on-the-job training and/or previous work experience. [b] Occupations at skill level 2 involve tasks of operating machinery or electronic equipment, maintenance/repair of electrical and mechanical equipment, manipulation, ordering and storage of information, with relatively advanced literacy, numeracy and communication skills. In general, it is necessary to have ISCED level 2 or 3 education, for some ISCED level 4. [c] Occupations at skill level 3 involve complex technical and practical tasks that are associated with short-cycle tertiary education, with a focus on factual, technical and procedural knowledge in a specialised field (ISCED level 5). [d] ISCED level 5 includes programmes that are generally more technical and occupation specific than ISCED 6–8 university programmes. ISCED 5 programmes equip students with the technical and practical skills to enter the labour market. [e] Occupations at skill level 4 involve tasks that require complex problem solving, decision-making and creativity based on extensive theoretical and factual knowledge in a specialised field. Occupations at skill level 4 are associated with ISCED levels 6–8.

Source: Author's elaboration, based on ISCO-08 and ISCED-2011.

Several graduates described the post of teller as a 'routine job', with the majority of branch employees interviewed arguing that a university degree was not needed to perform the tasks required on the job. To quote one graduate (B1), 'anyone with common sense can learn the system'.

The majority of employers similarly acknowledged that the position of teller was a 'routine' job (B6), in which proficiency was acquired by learning the system and operations of the bank on the job and which did not require 'complex analytical skills' (B2, B7). While there was no consensus among employers as to whether graduate skills were required to do the job, several employers (B6, B7, B8) argued that the teller position did not need graduate-level analytical skills because the only core skill was the ability to sell. Furthermore, customer

relationship management, which had been introduced in a few leading banks, had made cross-selling easier, since as soon as client details were entered, the system guided the banker as to which financial products to sell.

On the other hand, some bank managers (B3, B4) mentioned the increasing complexity of banking regulations, citing risk and compliance with all applicable laws, regulations and industry standards as a driver for upgrading entry-level educational requirements. Banking regulations were seen as becoming increasingly more complex with the introduction of the Foreign Account Tax Compliance Act (FATCA), the Common Reporting Standard (CRS), the Anti-Money Laundering (AML) Regulation, the Special Investigation Commission (SIC), and other Lebanese Central Bank requirements (B4).

Central Bank (Banque du Liban (BDL)) Circular 103 also stipulated that all branch employees including tellers, head tellers, customer service officers and representatives must obtain three certificates, namely: (1) Lebanese Financial Regulations; (2) Professional Banker Certificate; and (3) Banking Ethics. Only banking employees who were recruited before 1996 occupying the teller post were exempt from Circular 103. Some employers (B1, B2, B3, B4, B7) argued that these certification requirements had made the upgrading of education requirements necessary, as BDL exams were 'too technical' for non-graduates (B4, B2).

Several employers (B3, B4, B7) also mentioned that they did not hire tellers for them to remain in that position 'for life'. To this end, the upgrading of educational entry requirements for the role was fully justified, even if graduate skills were not strictly necessary to do the job. A number of banks (B3, B4, B5) emphasised the importance of fresh entrants starting their banking career at the branches, which they described as 'the pillar of the bank' (B4). Through the teller position, fresh entrants were exposed to banking operations and transactions which can only be learnt on the job. From this perspective, a university degree would be required initially to secure the position of teller, which was seen as a stepping-stone to further career progression within the bank and to assume more complex roles which would require graduate skills.

Even though there was wide disagreement among senior banking managers as to whether the sale of financial products was a graduate skill, the majority of employers and bank employees interviewed

agreed that non-graduates would reach a ceiling in their banking career upon assuming the main teller or junior customer service role, after which they could advance no further.

10.4.3 Graduate recruitment and labour market demand

The demand for jobs in the Lebanese banking sector far outstripped the number of vacancies. Many banks (B1, B2) did not advertise entry-level vacancies, because they already received a large number of résumés. Instead, banks allowed candidates to apply year-round online for entry-level positions. Banks described the demand for financial sector jobs as 'very high' (B2), with several banks (B3, B7, B8, B9) reporting receiving 3 000-4 000 résumés a year, of which less than 4–5% were successful in 2018. It was this oversupply that allowed the banks to be 'very selective' (B3), with one employer comparing the choice to 'going to a supermarket' and being faced with an ever-widening variety (B2).

Credential inflation, where the proliferation of the number of degree holders depreciates the value of a university degree, was evident in the interviews with employers, with many confirming that a particular degree no longer secured the same job it did in the past. Employers chose to hire from the graduate pool because it was admittedly to their 'advantage' (B2), given the 'high supply' of graduates. Several employers (B8, B2, B6) described a Bachelor's degree as the common educational attainment equivalent of a 'visa' on a passport, merely confirming that the candidate had 'the basics' to qualify for an entry-level position and nothing more (B6). One employer (B8) pointed out that 'highly-educated' in today's terminology implied at least a Master's degree.

When a bank had an entry-level vacancy, they sifted through the applications already filed and invited selected candidates for an interview. To facilitate the screening process, some banks (B2, B3) segmented universities into different tiers, with top-level universities identified by most interviewees as the older and more established universities. These included the American University of Beirut (established in 1866), the Lebanese American University (1924), Saint Joseph University (1875), the Lebanese University (1951), University Saint-Esprit of Kaslik (USEK, 1950), and Balamand University (1988). Other banks also mentioned some relatively new universities in their short list of good universities, such as Antonine University (1996), Ecole supérieure des affaires (ESA) Business

School (1996), La Sagesse University (1999)[14] and Notre Dame University – Louaize (1987). In addition to educational qualifications and previous work experience, employers also looked at extra-curricular activities when screening résumés. Several banks mentioned that they particularly valued volunteering (B1, B3, B7) and pursuits demonstrating responsibility such as scouting (B1), working with the Lebanese Red Cross (B7), or participating in activities that developed negotiation skills such as the Model United Nations (B1). The selection process that followed the screening procedure included language tests, behavioural and/or technical interviews, and personality and IQ tests, depending on the bank.

Tellers in Lebanon earn between USD 500–1 400 per month in basic income, depending on the bank and working hours, amounting to up to three times the minimum wage of USD 445 per month. The graduate wage premium for the teller position, according to the Collective Labour Agreement 2016–17, is LBP 200 000 (USD 132) or a 25% increase (see Table 10.3).

Even though their basic income may not be significantly greater than the minimum wage, depending on the bank, banking employees are paid 16 times a year and receive a number of additional benefits and perks[15]. Once recruited, the salary is contingent on position, grade and job performance, including technical and behavioural competencies. In the branches, employees also receive performance-based bonuses and commissions on the sales of financial products.

10.4.4 Higher education expansion and employers' perceptions of the quality of education

Employers' perceptions of the quality of higher education shaped their recruitment choices, leading to a segmentation of universities and 'multi-tier recruitment strategies' (Mason, 1996). Employers interviewed shared the perception that the quality of

education has effectively fallen with the expansion of higher education, so that a degree is no longer a signal of ability. Several employers pointedly referred to the 'cash-for-degrees scandal'[16] mentioning that certain Lebanese universities had been established for commercial purposes and were not sufficiently focused on providing a high standard of education. 'Universities sometimes just want the tuition fees, with no attention paid to quality,' said one employer (B3).

Despite existing legal provisions stipulating the regulatory framework, there are clear gaps in the regulation of private higher education institutions in Lebanon, as was made evident in the cash-for-degrees scandal. The draft law for the establishment of a national quality assurance agency in higher education, intended to ensure greater accountability of the higher education system, has remained dormant in Parliament since 2012. Given the lack of quality assurance mechanisms at the university level[17] in some of the newer universities, a number of employers (B1, B2, B8) argued that the type of secondary (high) school attended was a better signal of competence in second language acquisition[18], particularly if candidates came from reputable private schools.

This perceived discrepancy in the quality of education between the older universities described as top-tier universities by the majority of employers, and some of the newer universities established after the Civil War, has also led to a heterogeneity in graduate labour market outcomes, including in the same workplace. Because tellers were able to advance up the hierarchy, employers reported having no problem 'convincing' fresh graduates to begin their careers as tellers (B8). The majority of employers (B1, B2, B4, B7, B8), nonetheless, complained that graduates from 'elite' universities, referring specifically to graduates from the American University of Beirut (AUB) and the Lebanese

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[14] The business school at Sagesse University was only established in 1999 even though the law school dates back to 1875.

[15] Employees receive a 3% annual increment on salaries. Banks also pay a transportation allowance, social security contributions, annual paid leave of at least 15 days for fresh entrants, family allowances, education scholarships for children, a marriage bonus equivalent to one month's salary, a maternity bonus and medical insurance. Some banks also provide scholarships for their employees, loans at 0% interest rates, lunch, language classes and gym subscriptions.

[16] Over 40 people were arrested in Lebanon in March 2019, including the Director General of Higher Education at the Ministry of Education and Higher Education, on suspicion of issuing fake university degrees to individuals who were not students. Several HEIs, such as the American University of Culture and Education, the Lebanese French University, Sidon University College, and the Arts, Science and Technology University in Lebanon (AUL), were implicated.

[17] The initiative to create a draft law for the establishment of a national quality assurance agency in higher education to ensure greater accountability of the higher education system has also remained dormant in Parliament since 2012.

[18] In Lebanon some secondary schools are English-oriented and others favour French.

Table 10.3. Bank employee grades, associated positions and minimum wages

GRADE	POSITION	MINIMUM WAGE
Technician/Grade A	Tellers	LBP 725 000 (USD 478) LBP 925 000 (USD 610) if university graduate
Technician/Grade B	Junior officer (HQ) Customer relations officer	LBP 965 000 (USD 637)
Technician/Grade C	Officer (3–5 years) Assistant branch manager	LBP 1 400 000 (USD 924)
Cadre/Grade D	Senior officer Head of Section Assistant branch manager (big branch) Branch manager	LBP 1 950 000 (USD 1 287)
Cadre/Grade E	Head of Department Branch manager (big branch)	LBP 2 380 000 (USD 1 571)
Cadre/Grade F[a]	Head of Division	LBP 2 800 000 (USD 1 848)

Note: [a] The Cadre of General Management (general manager, deputy general manager, assistant general manager) lies outside the Cadre of Employees and therefore is not part of this grading system.

Source: Author's compilation based on the Collective Labour Agreement 2016–17.

American University (LAU), were more reluctant to start their career paths as bank tellers, perceiving it to be a routine job 'below their level'. One employer (B7) reported not having recruited a single AUB graduate as a teller, preferring to place them in head office positions instead.

Employers further distinguished between the older universities, referring to some of the older private universities, particularly AUB and LAU, as 'elite' universities. Several banks (B2, B4, B5) reported being unable to manage the expectations of graduates from elite universities, with at least two banks (B2, B9) observing the highest turnover in the teller position among elite university graduates. According to employers, graduates of these elite universities who started out as tellers had 'unrealistic expectations' (B11) and 'no concept of the career ladder' (B5), wanting to advance quickly to become managers (B3, B4, B5, B9), and faster than the usual promotion rate in place at the bank.

Employers contrasted elite graduates of private universities with public university graduates from the Lebanese University, who were praised for their technical skills, for having more 'humble'

expectations (B2, B11, B9) and for being more 'hungry for the job' (B5). According to employers, Lebanese University graduates were willing to start as tellers and were ready to work 'hard' (B1, B2, B4, B5), without expecting to become managers within a year of working at this level.

Several banks (B3, B5, B9) reported having widened their recruitment pool for entry-level positions, recruiting from some of the newer universities they had not considered in the past. The majority of banks interviewed, however, did not recruit non-graduates with a Baccalaureate or technical graduates with the Superior Technician (TS) tertiary degree[19], preferring university graduates instead (see Table 10.1). This was mainly due to the oversupply of university graduates and the perception that the quality of technical education was poor (B5). 'If I have the option to take a university graduate, why would I take a technical graduate and put money on training? I am taking

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[19] The TS tertiary degree requires two years of study upon completion of the technical baccalaureate (see Table 10.1, the column with the diploma at ISCED level 5).

a BA [Bachelor of Arts in Business] and I am still not satisfied and [they] need a lot more training,' said one senior manager (Bank 5). This made over-education less problematic for this employer, as 'there is a question about the quality of education so over-education is not a problem' (B5).

The ready availability of university graduates to assume the teller function made recruiting non-university graduates redundant. Some employers (B2, B4, B5, B6) also pointed to an achievement gap between technical and university graduates, particularly in language skills. One of the largest banks and a leading recruiter (B6) pointed out that even though TS students specialising in banking had the necessary technical skills, the question of proficiency in English was a 'barrier'. However, on the admission of some banks (B4, B6), technical tertiary graduates with a TS degree were more eager to learn and found the teller post more challenging, thereby suggesting a potentially better education and skills match. The vast majority of employers, nonetheless, argued that even if a TS graduate had the skills to perform the job of teller, they would not be able to take on other posts further up the hierarchy, which is why they preferred not to hire them.

Some banks (B3, B4, B7) considered TS graduates only for the teller or main teller role, with these banks being the exception and not the rule. A leading bank (B3), for example, found the recruitment of TS graduates to be a 'good formula' particularly for the main teller job, which includes additional routine tasks such as collecting money from the main vault and distributing cash to tellers, as well as replenishing the automated teller machine. According to this employer, banking employees who don't have a university degree are not as 'ambitious' as their graduate counterparts, a trait which serves the main teller position well since it requires stability.

In contrast to recruitment in the branches, several banks (B1, B4, B7, B8) interviewed preferred elite university graduates from AUB, LAU and Saint Joseph University (USJ)[20] for junior officer positions in their head offices. Despite the unsuitability of elite university graduates for the branches, these banks singled out these same graduates for their junior officer positions, which are more in line with traditional graduate mainstream career trajectories. Graduates from these elite universities were perceived to have a more solid academic training

background and stronger analytical (B7), linguistic (B1, B7, B8) and soft skills (B4, B7).

10.4.5 Millennial[21] expectations and graduate aspirations

The majority of graduates interviewed were millennials who expressed 'adapted preferences', adjusting their employment choices and aspirations to the grim realities of the Lebanese labour market (Lessman and Bonvin, 2011). According to one LAU graduate (B2), the Lebanese labour market 'can sometimes downgrade people's ambitions [...] forc[ing] them to settle for what is available' in the jobs market. 'You either stay at home or you accept the [poor quality] jobs on offer,' said another graduate (B3).

Secure and decently paid jobs with a career trajectory were scarce and graduates were well aware of this. According to one LAU graduate (B2), 'You expect to be paid higher or at least to find a job easier. You expect to graduate and work. I have many colleagues who graduated with me, but they are not working. Because if they find a job, they find a job with a very low salary, unless they are connected.' Another banker (B5) said, 'Thank God I have a job. When you see so many unemployed you can't dream high. We are a generation that lost hope. We just want work,' she said.

Graduate labour market expectations often clashed with labour market realities. Several graduates reported having aspired to more analytical roles in the head office, only to be told by human resources to start in the branches where there were more opportunities. A Master's graduate in finance from Saint Joseph University who had hoped for a career in the finance department at head office, for example, found herself working as a customer relations agent in a branch, having started her career as a teller six years ago. She reported not having expected her career trajectory to be 'so slow'. An employee (B8) who worked as a main teller considered his position the price he had to pay for choosing to return to 'Lebanon, the cedar!' At the time of interview, he was completing his Chartered Financial Analyst (CFA) exam and hoped to move into client portfolio management.

The evidence also pointed to a clear dissatisfaction with remuneration among branch employees. One bank employee (B8) confirmed that a recent job satisfaction survey revealed that the majority of branch employees were not happy with their salaries. Most of the branch employees interviewed

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[20] When banks complained about the attitude of elite university students in the branches, they did not mention Saint Joseph University graduates.

[21] Those born between 1981 and 1996.

also expressed dissatisfaction with the wages they received. According to one LAU graduate (B2), 'If you ask me whether it was worth to pay all this money [for my degree] to work in a job like this [junior officer], I would say no.' He reported earning USD 9 333[22] per year, whereas he paid USD 9 938 per term at LAU, or over USD 70 000,[23] for a Bachelor of Science (BS) in Business Studies. 'You pay a lot to graduate, and you expect more in return', he said. An HR senior manager agreed, saying: 'If we do these calculations [rates of return on university education], no one would be employed [in retail branches]' (B9). Several employers subsequently pointed to emigration rates among the highly skilled, with employees leaving the country after working in the banking sector for a few years, precisely because of low wages.

Some employers admitted that the low wages on offer at the branch level in relation to the high tuition costs paid by university graduates may be at the heart of this difficulty in recruitment and retention. However, some employers argued that the salary paid to a teller reflected the fact that they were being 'trained-on-the-job' in the operations of the bank (B2). One employer described it as 'pocket money, not a salary', with several employers (B2, B4) pointing out that young graduates continued to live with their parents and did not pay rent. Furthermore, despite the initial lower wages, employers argued that the banking sector did provide a clear and secure career trajectory (B6, B7), within which, upon assuming loftier positions, employees in the branches could earn higher salaries and bigger bonuses, depending on the size of the branch they were managing.

10.4.6 Cultural fit

In addition to academic credentials, cultural fit was another major consideration in the recruitment of new entrants into retail banks. Several employers (B3, B8) described cultural fit as blending with the 'image of the bank', having a corporate look and adhering to the core values of the organisation. Some employers spoke about a clash between the outlook and attitudes of millennials and the current banking culture.

When comparing their millennial workers with the former generation of banking employees, employers described the older generation as more perseverant (B6, B7, B2, B8), loyal (B4, B7,

B2), mature (B1, B4) and pragmatic (B4). One HR manager described millennials as having 'different expectations and aspirations' (B2) and 'being less ready to compromise'. They were perceived as more reluctant to assume certain jobs, such as job tellers (B4), with several employers (B4, B7) observing that millennials sometimes preferred to stay at home, unemployed, than work in an entry-level job that failed to meet their aspirations. Millennials also felt overqualified for these entry-level positions and impatient to advance in their careers (B2, B3, B4, B7, B8), whereas '10 years ago graduates would stay in the teller position without complaints' (B3). Weak language and writing skills, particularly in English, were other frequent complaints about millennial graduates (B1, B3, B9). On the upside, millennials were described as more 'innovative and creative' (B6), more tech savvy (B7) and more confident (B6).

Millennials valued flexibility, especially in working hours, and casual attire, but 'banking by nature is not flexible' (B2, B3, B6). These employers explained that at the bank decision-making is centralised, you need to punch in at 8:00 am and the culture is conservative. Some employers (B3, B4) specifically ascribed this cultural mismatch to the liberal education of elite universities, particularly AUB and LAU, which contrasted sharply with the rigidity of the banking culture. One employer (B1) observed: 'They send us emails as if they are sending WhatsApp messages.' Some graduates from these elite universities also addressed the cultural clash. One LAU graduate (B5), for example, compared the bank to a school, where if she arrived late, she was sent an e-mail. She aspired for a job with 'less routine and more freedom', where career mobility was quicker, and her skills were better utilised in the job.

In addition to the corporate banking culture, employers (B4) also mentioned the importance of fitting in with the culture of the branch, which was often also influenced by its geographic location. Even though at the head office banks did not consider sect or geographic origins, in the branches these were important factors that impacted business development in remote areas. As a consequence, all banks preferred to recruit branch employees from within the relevant geographic area. This allowed branch employees to feel more comfortable as they were in their own environment and could better navigate local cultural dynamics. As one employer (B1) put it: 'I cannot get someone who [predominantly] speaks French, for example, and put him in the Haret Hriek branch[24]. "Ah oui

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[22]   LBP 875 000 (USD 583) a month for 16 months.
[23]   The cost per credit is USD 827, with students expected to complete 92 credits to graduate with a BS in Business Studies.

[24]   A neighbourhood where French is not commonly spoken.

Madame." […] They will laugh at him. Clients will not accept him.'

Employers (B2, B3, B4, B7) believed that hiring branch employees from within the same geographic area would also facilitate business development and client relations. One senior manager (B3) pointed out that when his bank sent two private bankers to Zalka, the clients commented on how a leading bank in Lebanon could send only Hayyan and Ali[25], did they not have Elie and Tony?[26] Another senior manager (B9) mentioned that the profits of the branch suffered a blow when the bank hired a non-Armenian branch manager in Bourj Hammoud, an Armenian neighbourhood in Beirut. According to another employer (B3), all banks 'sort by sect but they don't say it'. Employers, therefore, did not perceive their recruitment practices as reinforcing sectarian divisions in the country, pointing out that 'sectarianism is not the culture of the bank but the culture of the country as a whole', and banks are 'not social reformers' (B3).

10.5 Conclusion

This case study has shed light on the ways in which graduate trajectories and labour market outcomes have changed since the turn of the Millennium in the retail banking industry in Lebanon. Whereas in the past bank employees would enter the bank without university qualifications and learn on the job, today a combination of forces, including automation, more complex regulatory frameworks, higher education massification and a greater emphasis on the sale of financial products and customer services, have all led to a shift in the skills and education levels required to perform entry-level retail banking jobs. Although the literature predicted the elimination of the teller position as a result of digitalisation, this case study has shown the resilience of this function in contexts where the cultural and legal barriers have significantly curtailed the speed of automation.

As a result, banks in Lebanon have not yet started to reduce the number of tellers, nor have they begun to merge the bank teller with the customer service function, as in other countries. Some employers in the country believe that the job of teller will become fully automated by 2030, while others say that the teller function will become a minor function under customer service. The number of customer service agents is also anticipated to decrease as more people carry out their banking transactions online and as robo-advisers become more readily available in the future. The end result is a retail branch increasingly focused on the provision of financial advisory services.

While the pace of automation in Lebanon has been slowed down by cultural and legal impediments, the graduatisation of the banking sector has progressed at lightning speed, with graduate credentials becoming necessary to gain entry-level jobs in retail banks. This case study has shown how the oversupply of university graduates relative to demand has facilitated the upgrading of educational requirements for entry-level jobs.

In the absence of quality control measures regulating higher education provision, university qualifications have lost their signalling function, particularly for graduates from the newer universities, thereby forcing employers in the retail banking sector to search for other indications of ability when screening candidates. This has led to 'multi-tier' recruitment strategies, with graduates from elite universities prioritised for head office positions, while other graduates are channelled into the retail outlets. Cultural fit also took on different meanings in head offices and in the branches. Whereas in headquarters merit trumped personal characteristics, in the branches, sectarian, linguistic and cultural fit were considered essential for a good job match.

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[25]   Suggesting Muslim names in the Lebanese context.
[26]   Suggesting Christian names in the Lebanese context.

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ANALYSIS OF ONLINE JOB VACANCIES AND OCCUPATIONS AND SKILLS IN DEMAND IN NORTH MACEDONIA

Aleksandar Kostadinov

New technologies provide opportunities for fast data collection from various non-traditional sources. Using the web-scraping tools in Python, this article analyses the occupation requests of more than 6 000 online job vacancies (OJVs) published in the most popular job portal in North Macedonia, Najdi Rabota. The OJV data was gathered over a year (15 August 2018 to 15 August 2019), before being pre-processed and categorised in accordance with the ISCO-08 classification system, up to the 3-digit level. With the use of machine learning tools for text analysis, the skills and qualifications demanded by employers in the harvested OJVs were further classified for the IT occupations (ISCO 3-digit) 'software and applications developers and analysts'. This article also contains a frequency analysis of real-time data scraped from OJVs taken from the same job portal for the period 1 January to 24 April 2020 to understand how the Covid-19 crisis has affected OJVs and how government restrictions on movement have influenced employers' daily postings of OJVs.

11.1 Introduction

The ILO defines labour market information (LMI) as information on current and future labour market trends and skills needs, including the availability of relevant skills development opportunities. The data sources and collection methods used for gathering labour market information are similar to those employed in other fields of studies. The main characteristics of the labour market data sources can be divided broadly into three groups, as shown in Table 11.1.

These three LMI data sources are statistical surveys together with administrative and web data. Although statistical surveys and administrative data sources have long been used in labour market analyses, drawing on information from the web and big data marks a relatively new approach, and was the main tool used in this study. In recent years, the amount of LMI conveyed through specialised web portals and services has grown exponentially, providing a great opportunity for real-time labour market monitoring (ETF, 2019).

The second column of the table shows the data types and how they are organised and stored. Based on the existing data sources, data types can

be organised into three common groups: structured, semi-structured or unstructured. Structured data refers to clearly defined data types, the structure and recurrent patterns of which make them easily searchable by an automated system. Unstructured data refers to data whose structure cannot easily be defined as a pattern or type, making searches challenging (e.g. free text, audio, video, and social media postings). Semi-structured data refers to data where the structure is partially defined (e.g. XML documents).

The data models presented in Table 11.1 refer to abstract models that organise elements of the gathered data. Broadly, these can be distinguished as one of two data models: relational and non-relational. Relational models organise data into one or more tables (or 'relations') of columns and rows, with a unique key identifying each row (Structured Query Language – SQL). Non-relational data models provide a mechanism for the storage and retrieval of data that is organised by means other than the tabular relations used in relational databases. The opposite of SQL, non-relational databases (NoSQL) are increasingly used in big data and real-time web applications. In this study, non-relational data has been collected and analysed.

Table 11.1. Main characteristics of labour market data sources

DATA SOURCE	DATA TYPE	GENERATION RATE	DATA MODEL PARADIGM	QUALITY	COVERAGE	ANALYSIS PARADIGM	BELIEVABILITY	VALUE
Statistical surveys	Structured	Periodical	Relational	Owner's responsibility	Owner's responsibility	Top-down and model-based	Owner's responsibility	Intrinsic
Administrative	Structured or semi-structured	Periodical	Relational	Owner's responsibility	Owner's and user's responsibility	Top-down and model-based	Owner's and user's responsibility	Intrinsic
Web portals/ services	Structured, semi-structured or unstructured	Near real time or real time	Relational and non-relational (NoSQL)	User's responsibility	User's responsibility	Bottom-up and data-driven	User's responsibility	Extrinsic

Source: Taken from ETF (2019).

The believability or credibility of the web-collected data is the sole responsibility of the data user. In order to exploit the use of web data, researchers and analysts deploy various techniques that ease discovery, extraction, movement, transformation, cleansing, normalisation, joining, consolidation and access. The data collected is raw, unprocessed and unstructured; hence, it is the user's task to use techniques that will lead to the discovery of a particular phenomenon within the data gathered.

All statistical surveys (including labour force surveys) use the sampling framework based on census data. The latest population census in North Macedonia was conducted in 2002, when nearly 2 million people residing in the country were registered[1]. As many changes have taken place in the population in the intervening period, one must be aware of the limitations of a sampling framework based on the 2002 Census. Since that time, there have been several attempts and plans to carry out a new census, without success. In 2011, trained teams by the State Statistical Office started to gather data from households, but the process was interrupted after several days. Last autumn, as part of preparations for the planned 2020 census, a partial census using a sample of the population was conducted, but official results have not been made public.

In the absence of recent census data, this paper uses high density population data from Facebook. In partnership with the Centre for International Earth Science Information Network (CIESIN) at Columbia University, Facebook releases mapping services that create the world's most accurate population datasets. These datasets are available at a resolution of 30 metres, and in the case of North Macedonia produce a figure of 2 088 374 people residing in the country (as of July 2019)[2]. A density map of the population in North Macedonia is shown in Figure 11.1. The most densely populated area, with a population of nearly 620 000, is the capital, Skopje, and its surroundings. The northwest part of the country (the Tetovo-Gostivar area) is the second most populated area, with approximately 320 000 residents. The third most densely populated region is Kumanovo (in the northeast), with nearly 130 000 people.

A key category of labour market information is data on the demand for skills. Analyses of labour demand and changing skill needs have become more important recently due to the increasing speed of change in the country. Change factors range from

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[1]   www.stat.gov.mk/OblastOpsto_en.aspx?id=31
[2]   https://dataforgood.fb.com/tools/population-density-maps/

Figure 11.1. Estimate of population density in North Macedonia

Estimate of population in North Macedonia (points on 1.1 km)
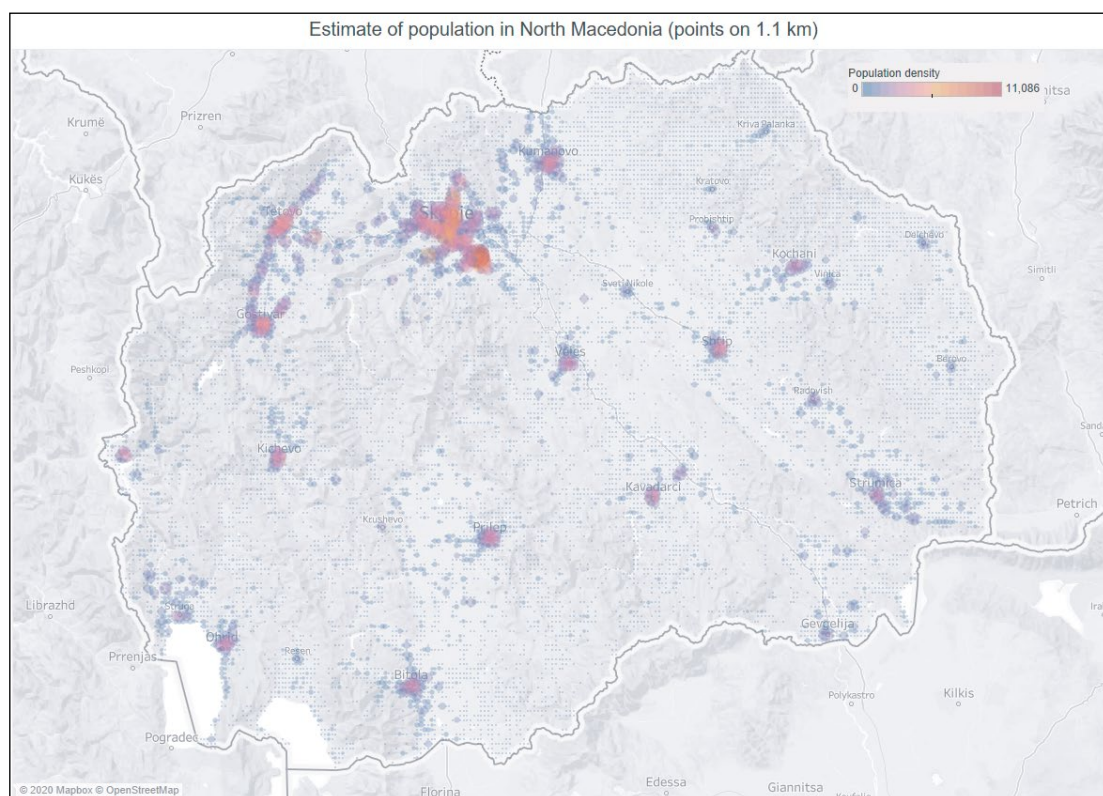
Source: Facebook Data for Good, https://dataforgood.fb.com/tools/population-density-maps/

educational expansion, demographic shifts and migration to globalisation, technological advances and digitalisation. As a result, despite increasing levels of education in the younger population, there are mismatches reported everywhere between people's skills and employers' requirements (Mojsoska-Blazevski/ETF, 2019). These developments require the regular monitoring of labour markets and more systematic analysis of the demand for occupations and skills.

Demand is ultimately linked to economic activity, while supply depends on population and education characteristics. In analysing skill needs, many data sources are used: censuses, labour force and other household surveys, business statistics, education and training figures, the national accounts and enterprise surveys (ETF-Cedefop-ILO, 2016a). In addition, registered unemployment and job vacancy data from public employment services and other administrative sources (e.g. tax and social insurance statistics), along with advertisement data from print, broadcast and internet media, can reflect which occupations and skills are in demand.

There is no one correct method of skills needs analysis. Several instruments and methods have

been developed to identify skills needs while affording a glimpse into the future. The most common approaches used in identifying skill needs can be broadly classified as belonging to four categories: employer surveys; qualitative methods (e.g. foresights, the Delphi method, focus groups, scenario development); quantitative model-based projections (forecasts); and sectoral/occupational/ regional studies (ETF-Cedefop-ILO, 2016b). These methods can be deployed at the micro-level (people, enterprises), the meso-level (sectors, regions) or the macro-level (macro-economic, national). Most exercises take approximate measurements of skill needs through looking at educational qualifications or occupations, with such studies taking the form of occupational projections or specific skill assessments, for example.

The most common form of skills needs identification is the use of company surveys that ask employers about current and future skills needs (ETF-Cedefop-ILO, 2017). Such surveys are used in almost all countries, despite their shortcomings – for example, employers can provide only the demand-side view, and most firms do not have a clear view of future demand in terms of numbers and skills.

Recently the potential of big data for labour market monitoring has attracted particular attention. The term big data mainly refers to information gathered from the internet, both on the demand side (e.g. vacancies posted on the internet) and the supply side (e.g. internet job searches, information posted on social media, Google Trends Data for forecasting aggregate labour market figures). Thus, using big data can mean drawing on a variety of sources: job search engines, employment service websites, classified job portals, company websites, online newspapers or social media, etc. Any LMI analysis using big data needs to consider the factors of volume, velocity, variety, veracity and value (ETF, 2019).

11.2 Methodology

This paper analysed web data that was collected through the process of web scraping from openly available web portals for job vacancy announcements. For this purpose, the Python[3] programming language and libraries necessary to download the content were used. In terms of content, the most popular OJV portal in North Macedonia – www.najdirabota.com.mk/ – was selected (see Box 11.1). Overall, more than 6 000 OJVs were downloaded from the website between August 2018 and August 2019. The script was coded and run in Jupiter Notebook, where more than 800 pages were scraped (see the modified Python code in Annex).

Initial expectations included obtaining country regional data in order to assess skills needs at the local level. However, during the pre-processing phase, it was found that there were too many missing fields in the cells assigned to describe job location, and that some vacancies had more than one job location entry. Such data entries could take a long time to process or even send out the wrong signals about vacancies' geolocation, as choosing the correct location of the job based on multiple entries would be a subjective decision.

After scraping the elements from the vacancy announcements with the use of the Python xlsxwriter[4] module, raw unprocessed data was downloaded in Excel format. For data pre-processing, MS-Excel software was used. In this phase, cells containing private data, such as the phone numbers and addresses of employers, were removed for further analysis.

The raw unprocessed data downloaded in Excel appeared in seven columns: 1. position, 2. qualifications, 3. short_description, 4. announceDate, 5. applyDeadline, 6. areas, 7. orgName[5].

The 'position' element in the dataset provides information about the name of the job or the occupation required. These vacant positions were later matched with the occupations listed in the International Standard Classification of Occupations (ISCO-2008) up to the 3-digit level. This was the most time-consuming process, given the fact that vacancies for more than 6 000 entries were pre-processed in Excel.

The second and third elements used from the scraped document were 'qualifications' and 'short_description'. These fields contain information about the skills, competencies and education needed for a certain position. In this paper, only the IT sector was analysed, and these two columns were pre-processed and matched to occupations related to ISCO-08 'Minor Group 251: Software and applications developers and analysts' (see Box 11.2).

For the pre-processing of the skills and qualifications within Minor Group 251, both MS-Excel and Orange3 were used. The latter is a component-based data mining software. It includes a range of data visualisation, exploration, pre-processing and modelling techniques. It can be used through an intuitive user interface or, for more advanced users, as a module for the Python programming language[6]. During the pre-processing phase in Excel, personal data from the vacancies were removed (names, descriptions, phone numbers), while in Orange3, a list of 'stop words' was created, that is, words that are repetitive and have little lexical value[7].

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[3] www.python.org/
[4] https://xlsxwriter.readthedocs.io/

[5] The following link explains the positions web scrapped and shouldn't open; it is a technical note for programmers: www.najdirabota.com.mk/json/VacanciesHandler.ashx?content=&dateFrom=17%2F08%2F2018&dateTo=17%2F08%2F2019&area=0&industry=0&employmentOrg=0&position=0&jobType=2&publishers=0&vacType=0&pageIndex=1&pageSize=10&fromPager=1
[6] For more information, see: https://github.com/biolab/orange3
[7] According to Wikipedia, in computing, 'stop words' are words which are filtered out before or after the processing of natural language data (text). Though 'stop words' usually refers to the most common words in a language, there is no single universal list of stop words used by all-natural language processing tools, and indeed not all tools even use such a list. Some tools specifically avoid removing these stop words to support the phrase search.

Box 11.1. Online job portal Najdi Rabota

The online job portal Najdi Rabota (in English: Find Job) is among the oldest of such sites in North Macedonia, having been active for more than 15 years. The statistics from the portal show that 135 727 OJVs were posted over the past decade. The data published is collected from daily newspapers and from companies, who can post their job vacancies there without paying any fees. In order to a post a vacancy, employers only need to create an account, which is also free of charge. The structure of the web portal allows web scraping because there is no need for registration, and OJVs are posted as text that can be easily extracted in Excel format without restrictions.

Source: Author's own elaboration from the online job portal Najdi Rabota: www.najdirabota.com.mk

Box 11.2. Occupations, job description and tasks of Minor Group 251 (ISCO-08 3-digit)

Job title (international classification): Software and applications developers and analysts

ISCO code: 251

Job description: Software and applications developers and analysts conduct research, plan, design, write, test, provide advice on and improve information technology systems, such as hardware, software and other applications to meet specific requirements.

Main tasks: The main tasks include:

- researching information technology use in business functions and identifying areas in which improvements could be made to maximise effectiveness and efficiency;
- conducting research into the theoretical aspects of and operational methods for the use of computers;
- evaluating, planning and designing hardware or software configurations for specific applications;
- designing, writing, testing and maintaining computer programs for specific requirements;
- evaluating, planning and designing internet, intranet and multimedia systems.

Occupations: Occupations in this group are classified into the following unit groups:

- 2511 Systems analysts
- 2512 Software developers
- 2513 Web and multimedia developers
- 2514 Applications programmers
- 2519 Software and applications developers and analysts not classified elsewhere

Source: ILO ISCO-08, www.ilo.org/public/english/bureau/stat/isco/docs/d2434.pdf

In the next phase of text pre-processing, regexes (regular expressions[8]) were removed. Regexes are special signs and characters used by programmers. Programmers often employ regexes in their expressions and their existence in text analysis influences frequency distribution.

An example of a regex is: ^, [, \t,], +, |, [, \t,], +, $.

The modules and libraries used in Python were NumPy[9], Json, urllib.request and xlsxwriter.

The approach used here is new and there is little evidence concerning the likely outcomes and precision of the technique. However, a number of tools and websites are emerging that analyse OJVs. The best known is Cedefop's pan-European

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[8]   https://en.wikipedia.org/wiki/Regular_expression

[9]   https://numpy.org/

Box 11.3. Skills Online Vacancy Analysis Tool for Europe (Skills OVATE)

The Skills OVATE offers detailed information on the jobs and skills employers demand in OJVs. The tool presents data collected from July 2018 until December 2019 in 28 European countries. In Skills OVATE, information can be accessed from millions of online job advertisements, coming from thousands of sources, including private job portals, public employment service portals, recruitment agencies, online newspapers and company websites. Skills OVATE provides information on occupations, skills and regions based on international classifications:
ISCO-08 for occupations, NUTS-2 for regions, ESCO version 1 for skills, and NACE Rev. 2 for sectors.

Source: Cedefop, www.cedefop.europa.eu/en/data-visualisations/skills-online-vacancies (last accessed 17 May 2020).

online vacancy analysis tool (Skills OVATE)[10], which is currently being improved by Cedefop to enhance the data quality and expand the functionalities of the system[11] (see Box 11.3). This process will involve all EU Member States.

11.3 Country context

11.3.1 Job market characteristics in North Macedonia

According to the Labour Force Survey, in 2018 the working-age population in North Macedonia was estimated at 1 682 702. About 57% of this population (approximately 958 000) participated in the labour market, while around 725,000 people were inactive (SSO, 2019). Activity rates vary according to age, gender, educational attainment, ethnicity and other features, with men and the higher educated more likely to be active in the labour market. In terms of age groups, the activity rate for those aged 30–45 was more than 80%, whereas in the youth population (aged 15–24) it was significantly lower (see Figure 11.2).

Similar statistics can be observed for employment rate with 47%, with the highest rates recorded for the 35–39 age group, while those aged 15–24 had a significantly lower than average employment rate (Figure 11.2). A major factor in the low activity rate among young people in North Macedonia is the compulsory secondary education, which ends at the age of 18, and easy access to university. Since 2006 there has been a boom in new faculties opening across the country, and the gross enrolment rate in tertiary education rose from 28% in 2006 to 42% in 2017, while the EU-28 level in 2018 was 69%[12].

It is important to note that there is a certain degree of occupational mismatch among the employed population. According to ETF calculations (Mojsoska-Blazevski/ETF, 2019), the overall rate of occupational mismatch rose from 19.6% in 2012 to 22.2% in 2017 among employees with higher education and was more common among men than women. For employees with an intermediate level of education, occupational mismatch remained stable at around 15% from 2012 to 2017 and was more common among women than men (ibid.).

The unemployment rate in North Macedonia remains high compared to the EU-28 but may be overstated based on the existence of an extensive grey market, estimated to account for between 10% and 20% of the country's GDP. The unemployment rate disaggregated by age (Figure 11.2) shows that young people aged 15–29 experience significantly higher unemployment rates than the population aged 30–64. The most recent data on unemployment shows that the North Macedonian economy recorded its lowest unemployment rate of 17.3% in the fourth quarter of 2019 (down from 32% in 2010), but it is expected to grow in 2020 due to the Covid-19 crisis.

Being educated increases one's employment chances in a labour market where the unemployment rate is high. In a comparison of the Western Balkan countries, in 2019 those with higher education were more likely to be in employment (Figure 11.3). In North Macedonia, employment rates for those with higher education were twice as high as for those with a low education level, while in Kosovo the figure was six times higher. The figures for the Western Balkan countries in the observed period – between 2012 and Q2 2019 – show

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[10] See: www.cedefop.europa.eu/en/data-visualisations/skills-online-vacancies/breakdown-occupation

[11] Skills OVATE expanded version to be released by the end of 2020.

[12] The data was extracted from the World Bank database: https://data.worldbank.org/indicator/SE.TER.ENRR. Gross enrollment ratio is the ratio of total enrollment,

regardless of age, to the population of the age group that officially corresponds to the level of education shown. Tertiary education, whether or not leading to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level.

Figure 11.2. Activity, employment and unemployment rates by age groups, 2016–18
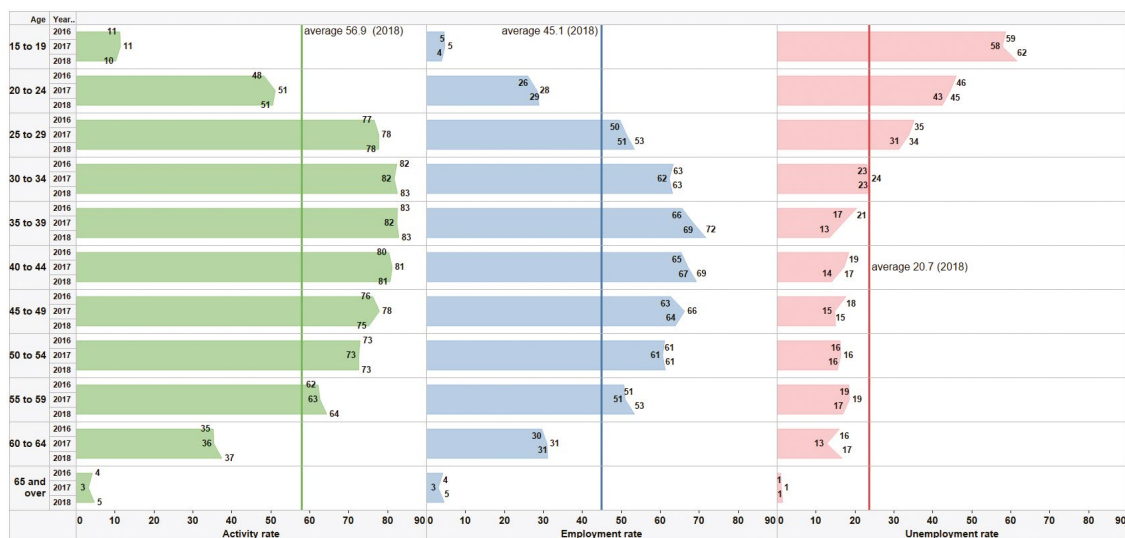
Source: Labour Force Survey (SSO, 2019), author's calculation.

that North Macedonia and Montenegro had the highest employment rates for those with greater educational attainment. Low educational attainment was correlated with a low employment rate (except for Albania).

According to calculations from the SEE Jobs Gateway Database, the highest increase in employment rates from 2012 to Q2 2019 in the Western Balkan region was among those who had a higher level of education, with a 11.5% increase registered in Serbia, followed by 9.4% in Montenegro and 8.1% in North Macedonia.

Employment by occupational group comprises statistics on jobs classified according to the most recent version of the International Standard Classification of Occupations (ISCO-2008). The National Classification of Occupations based on ISCO-08 distinguishes 10 major groups[13]: (1) Managers; (2) Professionals; (3) Technicians and associate professionals; (4) Clerical support workers; (5) Service and sales workers; (6) Skilled agricultural, forestry and fishery workers; (7) Craft and related trade workers; (8) Plant and machine operators and assemblers; (9) Elementary occupations; and (10) Armed forces occupations.

ISCO is widely used for occupational analyses and provides information about economic and labour

policies in areas such as educational planning and employment services. Occupational information is important for the identification of changes in skill levels in the labour force. Figure 11.4 shows the number of employees by occupational group between 2010 and 2019. As demonstrated, the number of employees in the ISCO group 'managers' contracted by 45% over this period. A similar pattern can be observed among 'elementary occupations', where the number of employees shrank by 42% (70 000 persons).

Other occupational groups registered high growth rates during this time, mostly driven by government policies, changes in economic activities (largely the result of attracting foreign direct investment in the automotive sector) and digitalisation. The most dramatic increase was observed in the number of 'skilled agricultural, forestry and fishery workers', with a 20-fold increase over the 10 years in question. This is mainly attributed to government policies in favour of subsidising the agriculture sector and campaigns to register informal jobs in the formal sector.

Other occupations that registered an increase in jobs were professionals (71.6%), technicians (34%), service and sales workers (55.7%), craft and related trade workers (29.7%), and plant and machine operators and assemblers (54.4%). Interestingly, the number of jobs in the category 'clerical support workers' remained stable over this period, along with occupations in the armed forces (Figure 11.4).

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[13]   www.slvesnik.com.mk/Issues/
b53b5fb3344040b89111d613cf1c6de4.pdf

Figure 11.3. Employment rates by educational attainment in the Western Balkan countries, blue 2019 Q2, orange 2012

Country	Low (levels 0 to 2)	Medium (levels 3 to 4)	High (levels 5 to 8)
Albania	49 / 45	53 / 54	67 / 62
Bosnia and Herzegovina	16 / 15	45 / 41	59 / 59
Kosovo	9 / 9	35 / 36	61 / 59
Montenegro	20 / 10	53 / 46	72 / 69
North Macedonia	25 / 21	54 / 47	71 / 62
Serbia	29 / 22	54 / 43	67 / 55
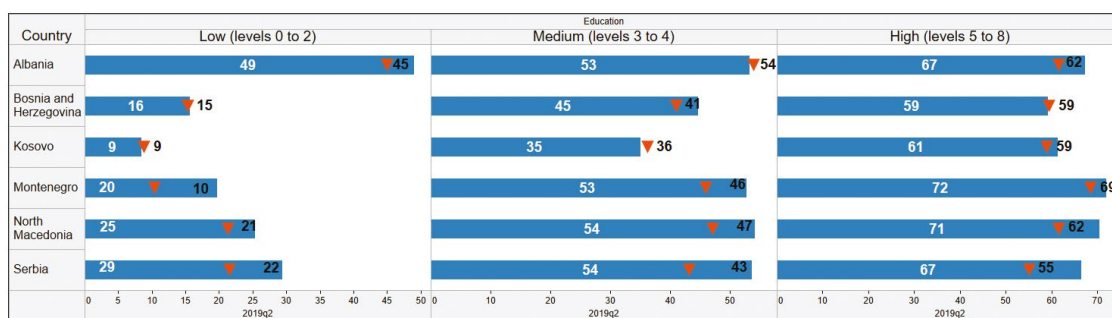
Note: Education levels based on ISCED: low – ISCED 0–2; medium – ISCED 3–4; high – ISCED 5–8.

Source: Vienna Institute for International Economic studies (WIIW), SEE Jobs Gateway Database: https://data.wiiw.ac.at/seejobsgateway-q.html, Author's calculations.

Figure 11.4. Employment by occupational group in North Macedonia (ISCO 1-digit, in thousands), 2010–19
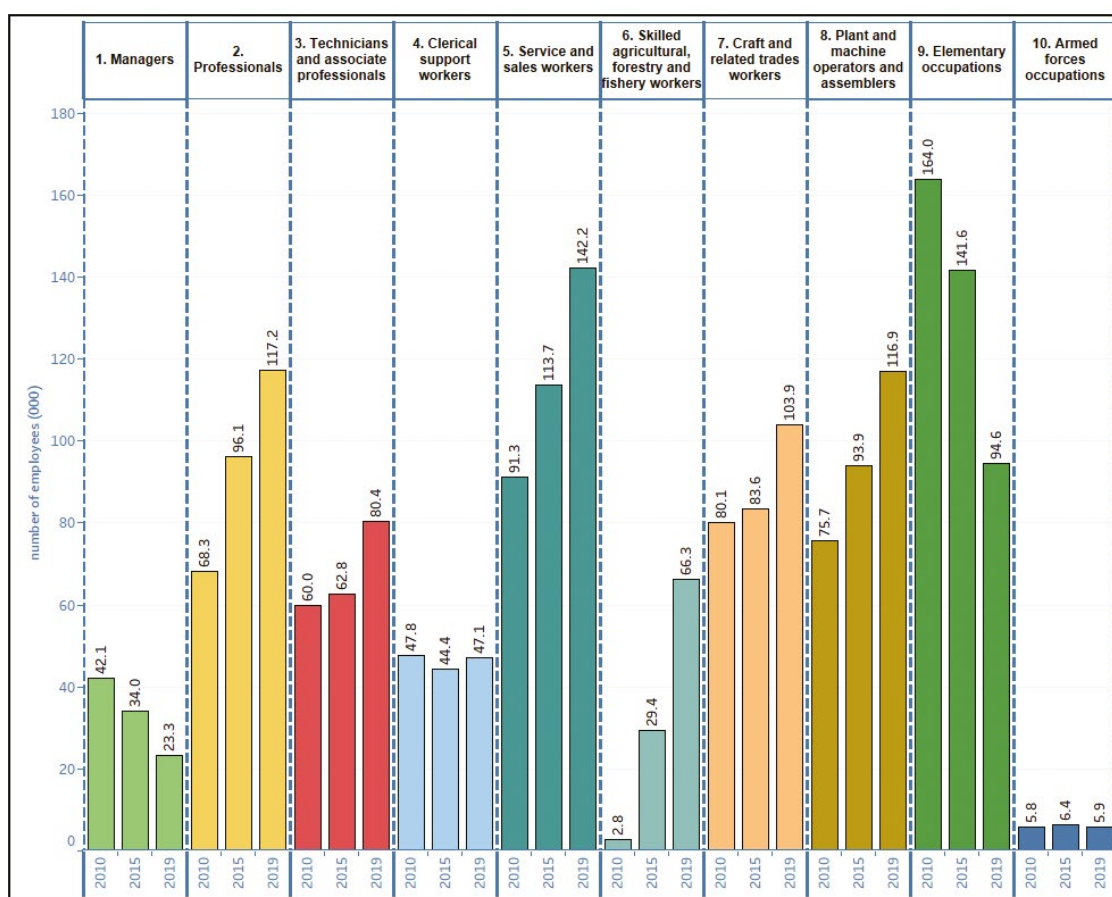
Source: Eurostat. Author's calculations.

In general, these significant changes in the shares of occupations can be explained by a number of factors, for example: shifting economic trends in the last decade with an orientation towards the service sector; the opening of technological free zones for automotive parts that led to the need for technicians and plant machine operators; and strong growth in the IT sector, where the demand for highly skilled professionals has been growing rapidly in recent years.

11.3.2 Practices of demand analyses for occupations and skills

In North Macedonia there is a relatively plentiful supply of information regarding the labour supply side (e.g. the numbers of graduates by education as well as those who are unemployed and/or looking for work, together with their age and residency profiles, etc.), with quarterly labour force survey results and education statistics key data sources in this respect. However, there is less information available on the labour demand side, which suffers from a lack of well-structured data broken down by occupations and skills. This is mainly due to the ad hoc structure of existing demand analysis. There are only two regular surveys on skills demand: the annual employer survey on skill needs conducted by the Employment Service Agency (ESA), and the annual vacancy monitoring conducted by the State Statistical Office (SSO) (ETF, 2016). Other institutions involved in these demand analyses are the Ministry of Labour and Social Policy, the Ministry of Education, chambers of commerce, employers' organisations, universities, NGOs and international donors.

The employer survey on skills needs has been performed by the ESA on an annual basis since 2009. A questionnaire is sent to a representative sample of private-sector companies with more than seven employees (ETF, 2016). The analysis in this case relies on the aggregation of employers' opinions and the information gathered is used in the planning of training budgets and programmes (ESA active labour market programmes). The Ministry of Labour and Social Policy and the ESA have also initiated a series of focus group discussions with employers to gather additional information on jobs and skills demand. The results of the survey are published in an annual report, which gives information on the jobs identified by employers as the needed and hard-to-fill occupations in the upcoming 6–12 months. The hard-to-fill occupations are not coded according to ISCO occupational groups, and their names are only listed in a text format. The ESA publication *Survey on skills needs for 2020*[14] provides the results from November 2019 regarding required occupations in relation to educational attainment, statistical region and NACE sector.

The other job vacancy survey is performed by the SSO annually to collect and analyse jobs vacancies by sector and occupation (ETF, 2016), with the results published on a quarterly basis in the news release on job vacancies[15]. The subjects of this survey are selected on the basis of a sample that includes enterprises engaged in activities B–S (according to the National Classification of Activities NACE Rev. 2) and which have three or more employees. This sample takes in all large and medium-size enterprises, while other businesses to be included are selected randomly. In 2019, the number of business entities in the sample was 3 787[16]. The SSO news releases give information on the number of job vacancies by ISCO 1-digit main groups.

Occasionally, the country's chambers of commerce conduct surveys of their member firms on their skills and occupational needs. The primary focus is on 'hard-to-fill occupations' and the findings are presented and used in commissions and working groups that deal with the planning of operations for active labour market policies and developing national occupational standards. The first batch of national occupational standards were developed in 2016 during a process of collaboration among employers' organisations, chambers of commerce and other stakeholders. They were issued as statements describing the different skills utilised across occupations and sectors, and outline what an individual needs to do, know and understand in order to carry out a particular job or function.

The results of these surveys give some information on labour and skills demands, but they are not always comparable, mainly due to the use of different definitions, classifications of occupations and skills, and methodologies. Furthermore, conducting surveys takes a long time in terms of data collection and processing and analysing the results, while there may also be problems linked to the important role played by international donors in financing and leading these analyses. Although not problematic in itself, such support often risks the loss of the capacity and expertise built up during projects when the donors' funding ceases. There is thus a need to transform the results of successful projects into more regular structural approaches, as a comprehensive and systematic monitoring of the economic demand for occupations and skills is not yet fully functional in North Macedonia.

National occupational standards are developed on a regular basis to identify and reflect what the expectations for a particular job look like. However,

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[14] https://av.gov.mk/content/Dokumenti/Anketa%20za%20 potreba%20od%20vestini%202020%20w.pdf

[15] SSO news release on job vacancies in 2019, see: www. stat.gov.mk/pdf/2019/2.1.19.32_mk.pdf

[16] SOS guidelines on methodology: www.stat.gov.mk/ MetodoloskiObjasSoop_en.aspx?id=112&rbrObl=14

they need to be re-evaluated and updated regularly in order to meet educational purposes, for example in terms of technical and vocational education and training. Currently more than 200 national occupational standards have been developed and approved by the Ministry of Labour and Social Policies[17], but the skills and qualifications listed need to be frequently revised and repackaged as new occupations emerge on the labour market.

Recently two projects backed by international donors have begun to implement a more in-depth analysis of skills needs and forecasting – 'Skills Observatory' and 'Long-term forecasting of the labour market through the HERMAC model' (Mojsoska-Blazevski/ETF, 2019, p. 18; ETF, 2016; ETF, 2015). The former is implemented through the World Bank's project 'Skills Development and Innovation Support' within the capacity-building strategy of the Ministry of Education and Science, which is planned to close by April 2021[18]. The concrete results of this initiative are not known yet. The latter EU-supported project is relatively comprehensive and has many advanced features. It was launched in 2013 to utilise the EU's methodology for long-term labour market forecasting in the country (the HERMAC model), as part of the support given to boost the forecasting capacities of the Ministry of Labour and Social Policy[19]. The HERMAC model was developed from an original model, HERMIN, in a twinning project (Support to the National Employment Policy, 2012–13) to establish long-term labour market forecasting (ETF, 2016). It explores demographic development and labour supply, long-term labour demand structured in 14 sectors, and skills mismatch according to ISCO and ISCED classifications (ibid.). HERMAC enables the analysis of medium- to long-term forecasts based on a simple multi-sector macro-economic model. It has been adapted from a model used in other countries and tailored to the specific context of North Macedonia. Final results of the analysis are unknown.

11.4 Results from the web-scraped data analysis

The analysis of OJVs can complement traditional survey data sources and provide insights into occupational and skills needs relatively cheaply

and quickly. The web-scraped data used in this paper included more than 6 000 OJVs published between August 2018 and August 2019. Results from the scraped data were analysed and visualised in 'Tableau' – a business analytics software which provides interactive visualisations and business intelligence capabilities with an interface for end-users to create their own reports and dashboards[20].

According to the results obtained from the web-scraped data, the ISCO 1-digit occupational group 'professionals' was the most requested among all the occupational groups for the observed period (accounting for almost 28% of all OJVs published on the job portal). This was followed by the ISCO group 'service and sales workers' (25.4%). These two ISCO groups together make up about 53% of total online job demand. The third most sought after occupational group was 'technicians and associate professional' (almost 15%), followed by elementary occupations (9%), clerical support workers (9%) and skilled agricultural workers (8%). More detailed analysis by occupation is possible as these vacancies could be classified up to 3-digit ISCO occupations.

To make the analysis more interesting, the results obtained from the web-scraped data are compared with the results of the job vacancy survey (taken from the SSO news release on job vacancies). The period chosen for the SSO's survey data is July 2018 to June 2019, which is the closest comparable period to that covered by the web-scraped data (15 August 2018 to 15 August 2019). According to the SSO data (Figure 11.5), 33 073 jobs were reported as vacancies during the observed period. The highest number of job vacancies was in the ISCO group 'service and sales workers', with almost 33% of all positions advertised. This was followed by: plant and machine operators and assemblers (nearly 15%), technicians and associate professionals (13%), and clerical workers (12%).

This comparison between the web-based results and the vacancy monitoring survey data shows significant discrepancies for the same occupational groups (see Table 11.2). The web portal indicates the highest demand for professionals (28% of all vacancies), while the survey data shows low demand for professionals (only 7.3% of all vacancies). The demand for service and sale workers is high in both the web- and survey-based data (25.4% and almost 33% respectively).

17   See the national occupational standards: http://csoo.edu.mk/pocetna/standardi/standardi-na-zanimanja/
18   See: https://projects.worldbank.org/en/projects-operations/project-detail/P128378
19   For more information on the HERMAC model, see: www.cedefop.europa.eu/files/poster_fyrom.pdf and http://ophrd.finance.gov.mk/wp-content/uploads/2017/03/C1-Flyer-Twinning-ANG-final.pdf

20   For more information, see: www.tableau.com/. See author's Tableau showing the research findings here: https://public.tableau.com/profile/aleksandarkostadinov#!/vizhome/Tableau_15891784046170/ISCO

Figure 11.5. Number of job vacancies by occupation, Q3–Q4 2018 and Q1–Q2 2019

Source: SSO, news release on job vacancies. Author's calculations.

The web portal results reveal that the third most requested group is that of technicians and associate professional (almost 15%), while the survey data show similar levels of demand for plant and machine operators and assemblers (almost 15%), and technicians and associate professionals (13%). There is comparable demand for clerical workers in both the web portal and survey data (9% and 12% respectively), and for elementary occupations (9% and 11.5% respectively).

It can be seen that the biggest discrepancy in the percentages between the institutional and the web-scraped data falls under the second main group – professionals (20 percentage points difference), although the variance in the fifth occupational group – service and sales workers – is not small either (7 percentage points). The group 'professionals' is over-represented in the web-scraped data compared to its very low share in the survey data. On other hand, the group 'service and sale workers' is less present in the web-scraped data compared to the SSO survey data. The explanations for this could be as follows:

- Methodological approach: The SSO survey-based data capture only a random sample of 3 778 small and medium-sized companies with

three or more employees[21]. There is a chance that small IT companies are not involved in the survey, while a significant number of positions advertised in online vacancies appear to be hard-to-fill positions for IT professionals.
- Data entry and coding problems in the survey data: The data provided by the surveyed employers may be inconsistent since not all data providers (in companies) are trained or instructed to distinguish ISCO occupations and report positions in the appropriate group.
- Reappearance of adverts for the same job vacancy on the web: It is quite common for the same job vacancies to reappear for certain positions which are difficult to fill. This tendency could generate more web data from the same employers and result in an apparently higher demand for this group of occupations.
- Companies and small businesses that rarely use the internet tend not to publish OJVs and risk being underrepresented in the sample, which could be the case regarding 'skilled agricultural, forestry and fishery workers' from Table 11.2. Modern companies that use digital technologies have a higher tendency to use OJVs.
- ISCO (1-digit) major group 'managers' is also underrepresented (accounting for between 0.2% and 0.4% of vacancies) in both the survey-

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[21] For more details, see: www.stat.gov.mk/ MetodoloskiObjasSoop.aspx?id=112&rbrObl=14

Table 11.2. Comparison of the most demanded ISCO main occupational groups, Q3–Q4 2018 and Q1–Q2 2019

MOST DEMANDED ISCO MAIN OCCUPATIONAL GROUPS	% OF TOTAL (SSO)*	WEB % OF TOTAL**
1. Managers	0.4	0.2
2. Professionals	7.3	27.9
3. Technicians and associate professionals	13.2	14.8
4. Clerical support workers	12.1	8.9
5. Service and sales workers	32.5	25.4
6. Skilled agricultural, forestry and fishery workers	1.2	0.1
7. Craft and related trades workers	7.1	8.3
8. Plant and machine operators, and assemblers	14.6	5.2
9. Elementary occupations	11.5	9.3

Source: * Data from the SSO news release on job vacancies. ** www.najdirabota.com.mk/. Author's calculations.

based and web-scraped data, as most of the positions within this group are occupied by public servants, whose recruitment is managed in different ways.

11.4.1 More disaggregated analysis of OJV results
The interactive dashboards created in Tableau can generate various visuals showing the results from different angles, and thus afford valuable insights into the data. For example, the screenshot of the dashboard shown in Figure 11.6 provides information about the main occupational groups (1-digit) and frequency distribution by month. As demonstrated, there is a pattern which correlates with the seasonality of the economic activities throughout the year (February–May and September–November), showing that more vacancies were advertised in some months than others. The tables on the right-hand panel of the dashboard show the results in absolute numbers and percentages by occupation. As mentioned before, the most requested occupational group in the OJVs is 'professionals' (nearly 28%), followed by 'service and sales workers' (25.4%).

Figure 11.7 shows a screenshot of the dashboard that represents the percentage of OJVs by ISCO sub-major groups of occupations (2-digits). The left-hand graphic shows the names of the occupations advertised and their share of the total vacancies. The most in-demand occupations in

the observed period were sales workers with 16.9% of total, followed by business and administration associate professionals (9.4%), and business and administration professionals (7.7%). The table on the right-hand side of the dashboard gives the entire lists of occupations by sub-major ISCO 2-digit groups and codes.

When an ISCO 1-digit group is selected in the interactive table, the right-hand panel of the dashboard filters the results, as shown in Figure 11.8. In this case, ISCO 1-digit group 'professionals' is selected, with the filtered data showing the 2-digit sub-major occupations requested, broken down within their group. The figure clearly shows the highest demand for business and administrative professionals (code 24), ICT professionals (code 25), and science and engineering professionals (code 21).

Similarly to the ISCO 2-digit groups, the dashboard shown in Figure 11.9 visualises the percentage of ISCO main occupational groups versus minor occupational sub-groups up to 3-digits. The interactive online visual allows highlighting the results for one of the main group occupations on the left-hand side and filtering the occupations for the minor groups in the right-hand panel. The totals show that 'shop salesperson' is by far the most advertised role overall (14.7%).

Figure 11.6. Dashboard of ISCO 1-digit occupational groups by month
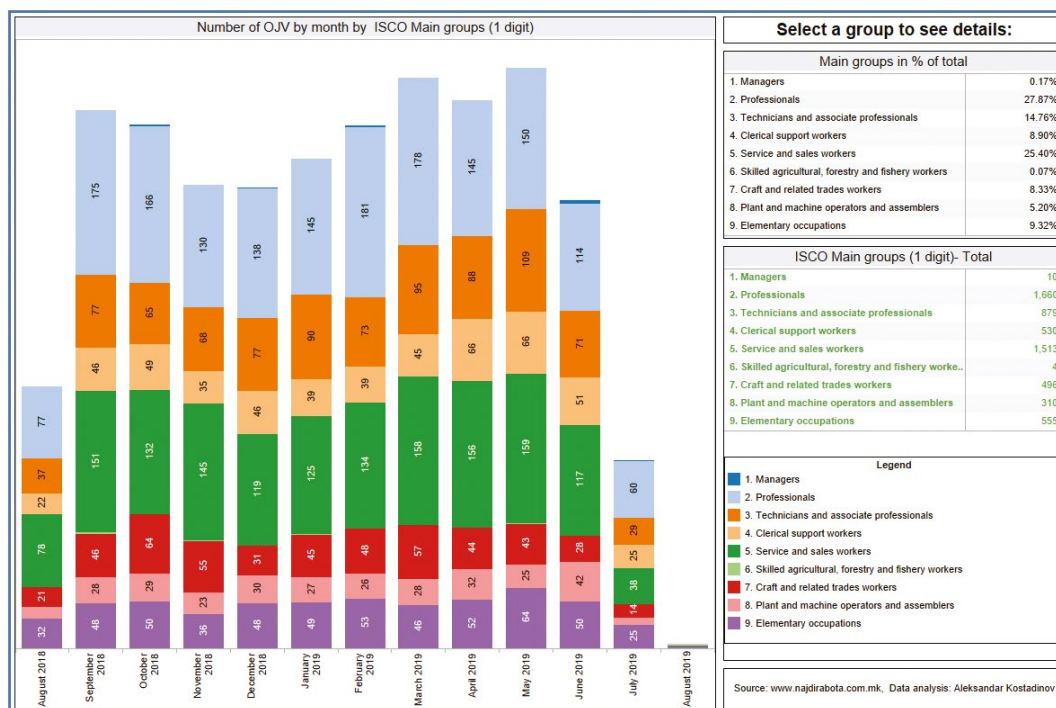
Source: www.najdirabota.com.mk/. Author's calculations.

Figure 11.7. Dashboard of ISCO 2-digit sub-major occupational groups
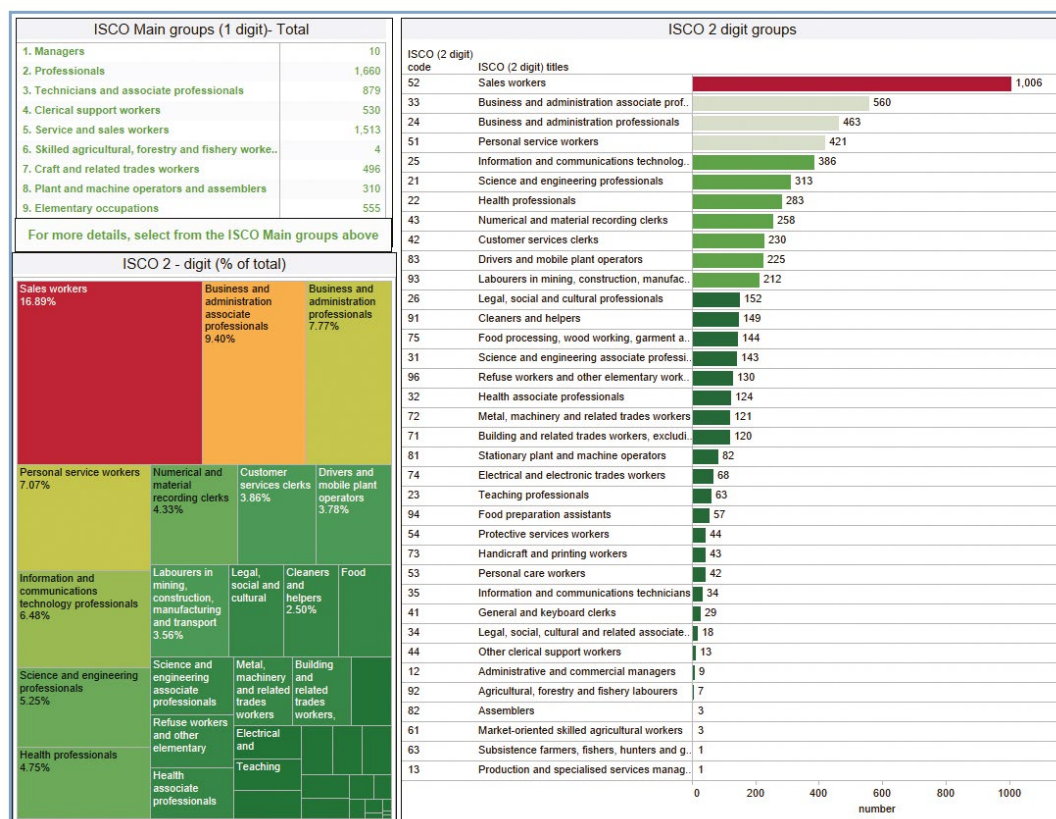
Note: The print screen can be seen here: https://public.tableau.com/profile/aleksandarkostadinov#!/vizhome/Tableau_15891784046170/ISCO

Source: www.najdirabota.com.mk/. Author's calculations.

Figure 11.8. Screenshot of the workbook at ISCO 2-digit when 'professionals' is selected

ISCO (2 digit) code	ISCO (2 digit) titles	number
24	Business and administration professionals	463
25	Information and communications technolog..	386
21	Science and engineering professionals	313
22	Health professionals	283
26	Legal, social and cultural professionals	152
23	Teaching professionals	63
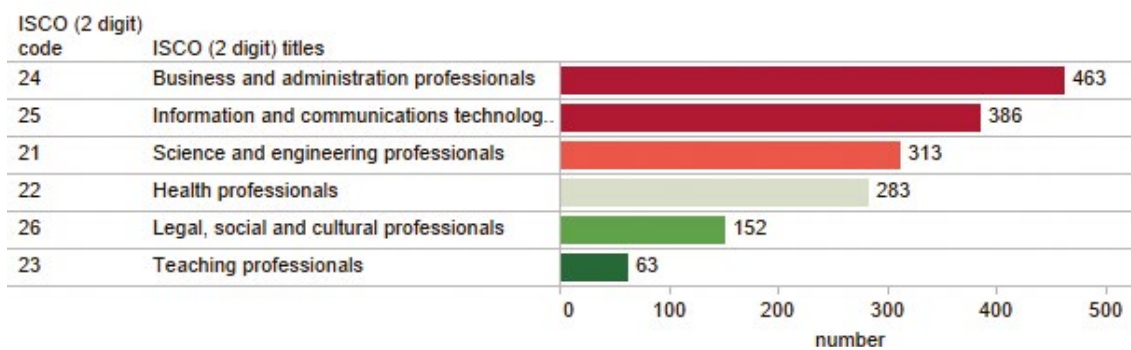
Source: www.najdirabota.com.mk/. Author's calculations.

Figure 11.9. Showing ISCO 3-digit occupations by selecting the service and sales workers group in the interactive Tableau tool
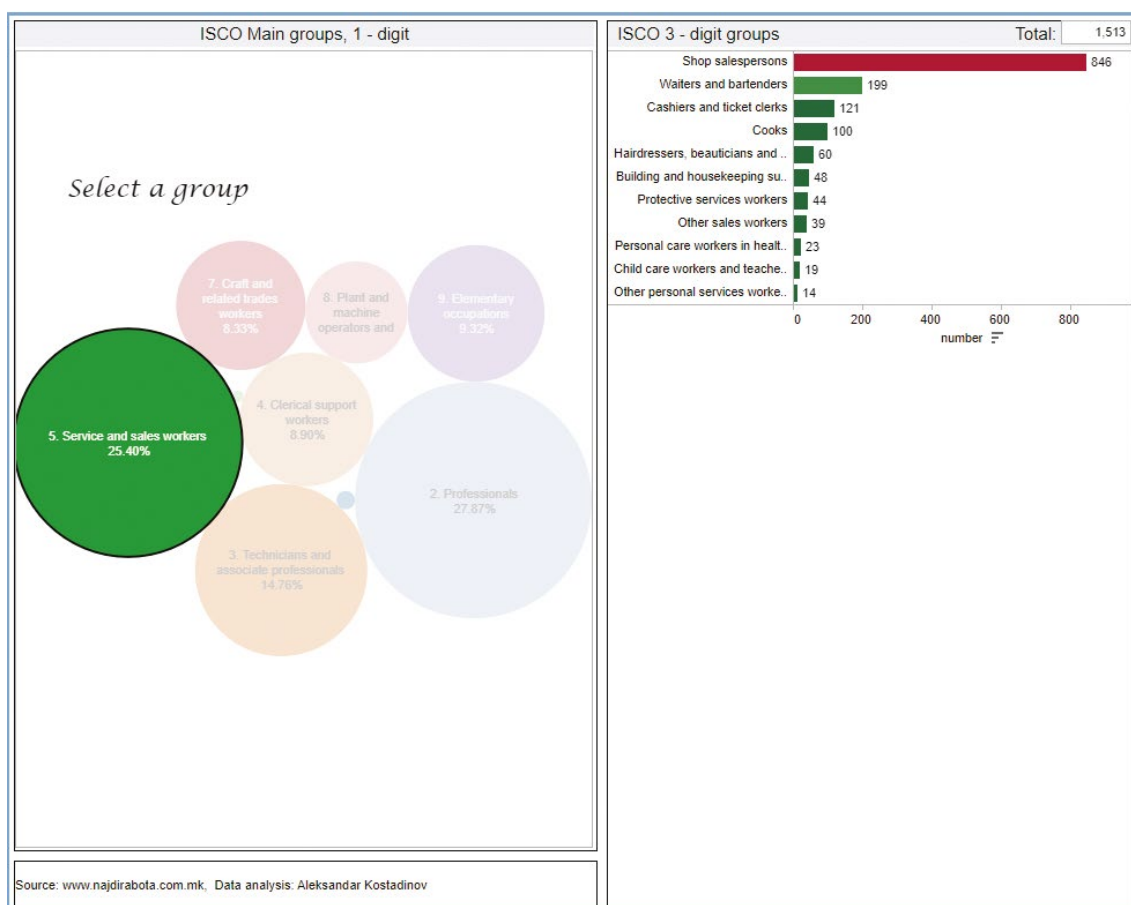
Source: www.najdirabota.com.mk/. Author's calculations.

Figure 11.10. Number of occupations disaggregated at ISCO 3-digit level

Source: www.najdirabota.com.mk, Data analysis: Aleksandar Kostadinov
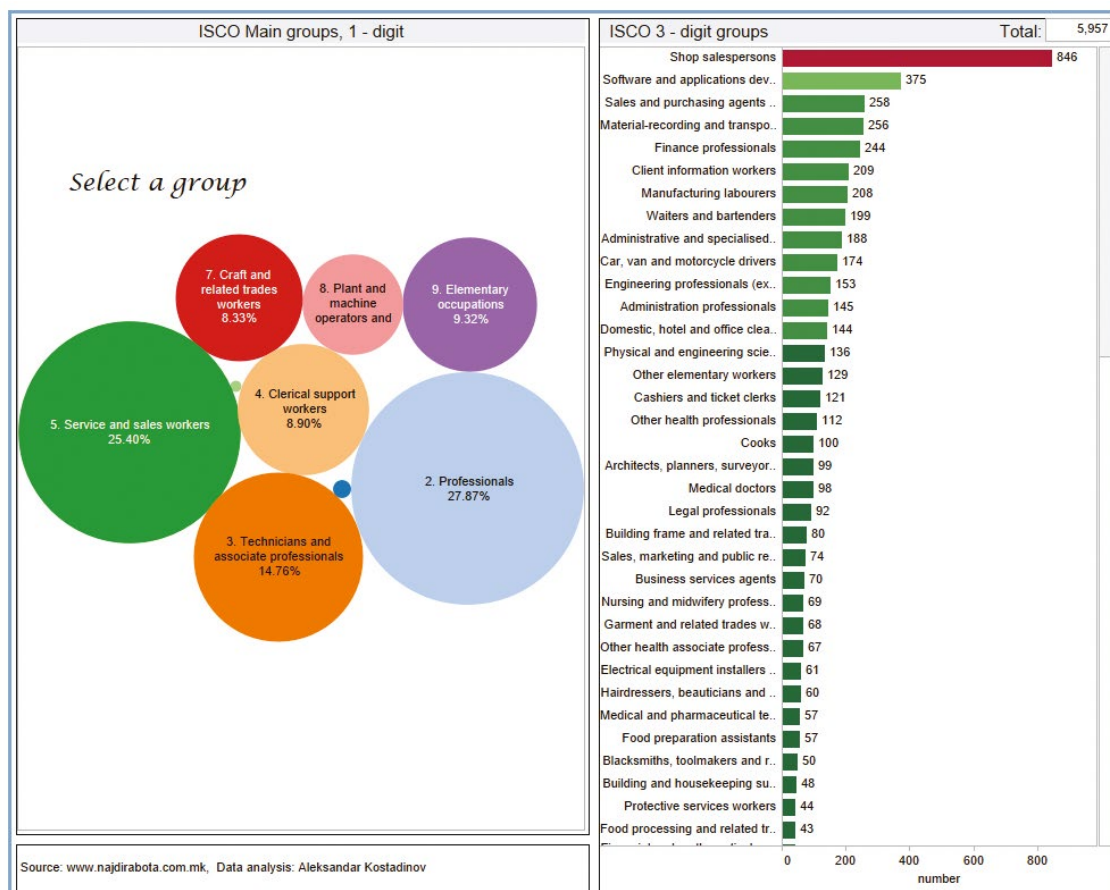
Source: www.najdirabota.com.mk/. Author's calculations.

The visual representation in Figure 11.10 shows the relative size of the demand for the main occupational groups on the left-hand side, which then filters and calculates the ISCO 3-digit minor groups in the graph on the right-hand side. Accordingly, we can see that 'shop salesperson' was the most requested occupation among the group of service and sales workers, followed by 'software and applications developers and analysts' and 'sales and purchasing agents'.

The specific skills demand for IT occupations is shown in the form of a word cloud in Figure 11.11, which was prepared in Orange3 based on the web-scraped data from the online job portal Najdi Rabota. This graphic visualises the skills demanded by employers for the ISCO minor group 'software and applications developers and analysts' (code 251). In total, 374 OJVs within this group were detected from the web-scraped data over the observed period (15 August 2018 to 15 August 2019). The figure shows the need for a mixture of soft skills (problem solving, analytical thinking, English, communication, etc.) and hard

skills. The main part of the cloud relates to skills in programming languages and those required for the use of web technologies and databases. The most prominent words in the centre of the word cloud represent the skills and qualifications most frequently demanded within this group. Words that appear on the periphery of the word cloud are less often requested but appear in a number of employers' OJVs.

Sometimes word clouds become overwhelmed with text and the most relevant information cannot be seen. The word cloud depicted in Figure 11.11 contains more than 200 words taken from the OJVs, so, in order to aid analysis, the top 16 most frequently cited skills and qualifications were extracted and are presented in Table 11.3. This clearly shows that proficiency in English is the most demanded of the skills required for IT professionals within ISCO group 251. The majority of the IT companies in North Macedonia are foreign owned and provide services for the international market, hence it makes sense that English skills are requested by employers.

Figure 11.11. Word cloud representing the skills and qualifications most frequently demanded by employers looking for software and applications developers and analysts

Source: www.najdirabota.com.mk/.

Table 11.3. Frequency of the top 16 most requested skills and qualifications for IT professionals – ISCO 251: Software and applications developers and analysts

WEIGHT	WORD	WEIGHT	WORD
168	English	50	php
90	javascript	41	analytical
88	net	41	Web
80	sql	37	java
67	css	34	js
65	html	32	git
60	communication	31	solving
56	c	30	problem

Source: www.najdirabota.com.mk/. Author's calculations.

11.4.2 Real-time data and OJVs during the Covid-19 crisis

The most important benefit of this methodology is the ability to monitor real-time data from OJV portals, which can then send signals regarding current trends to policy makers. This section uses the same methodology with the Python code (see Annex) to take a brief look at the impact of Covid-19 on OJVs as an example of real-time data. The web data has been scraped from the same job portal for the period of 1 January to 25 April 2020, including more than 1 400 OJVs in total.

As Figure 11.12 shows, the number of daily vacancies had risen by mid-January, reaching nearly 23 new job vacancies per day (on a 7-day average).

Figure 11.12. Number of daily and weekly online job vacancies on the job portal, 1 January–25 April 2020
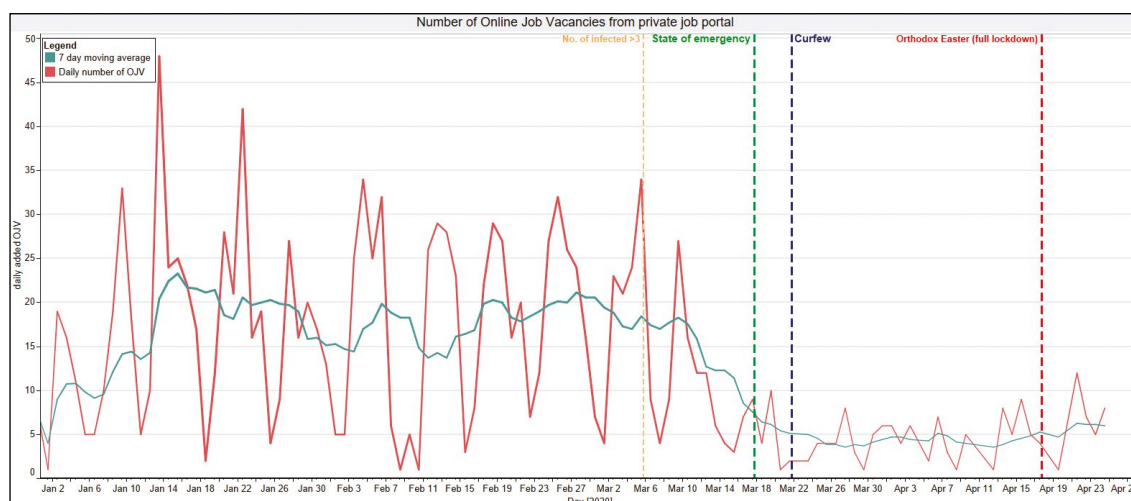
Source: www.najdirabota.com.mk/. Author's calculations.

This trend continued until the beginning of March, at which point there was an increase in the cases of Covid-19 detected in the country. A sharp decline in OJVs as of early March is clearly visible in the figure. In the period after declaring a 'state of emergency' and introducing a police curfew, the number of new OJVs further decreased to a rate of between one and five new OJVs per day. Rumours about relaxing lockdown measures after the Orthodox Easter had a positive impact on employer's expectations, with a short trend upwards showing more OJVs posted towards the end of April.

11.5 Conclusions

This article offers a new solution to the question of how to gather information and data on employers' demands for particular occupations and skills. By collecting data from OJVs, the most requested skills and occupations can be easily tracked, and the information utilised to quickly adjust policy responses to ensure a better matchmaking process in the labour market. The research outlined here used open data freely available on the web, gathering information from OJVs published on the most popular online job portal in the country (www.najdirabota.com.mk). The information was then anonymised and aggregated at the national level, and the results analysed with freely available software tools for statistical and text analysis like Python, Tableau and Orange3.

The results from the web-scraped data indicate that the highest demand is for professionals (accounting

for more than a quarter of all vacancies). This is closely followed by service and sales workers and these two groups together make up more than half of all online vacancies. A relatively high demand was also observed for technicians and associate professionals, elementary occupations, and clerical support workers. These main occupational groups can be further sub-divided by 2-digit and 3-digit occupations.

A comparison of the web-based results with survey-based data from SSO shows significant discrepancies in demand for the same occupational groups. The demand for professionals in the survey data is very low, while the highest demand is seen for service and sale workers (one third of all reported vacancies). The level of demand for technicians and associate professionals is similar and relatively high in both sets of data, while requests for plant and machine operators and assemblers is high only in the survey-based data. Finally, the demand for clerical workers and elementary occupations is similar in both datasets.

One explanation for these differences is the low representation of certain sectors and types of companies on online job portals. Small businesses and traditional sectors tend to use the internet less and recruit via other means. Thus, we might see a lower number of OJVs in the web-scraped data regarding construction sector occupations or agricultural work. On the other hand, modern companies that make use of digital technologies are more likely to recruit staff via OJVs, meaning that IT professionals might be over-represented

in the web data. Moreover, jobs in the public sector are rarely advertised on commercial and online job portals. As these jobs generally pertain to legislators, managers and administrators, these roles might be under-represented compared to other groups. This omission could be solved by adding jobs from the Agency of Civil Servants to the database.

Another explanation could be the high possibility of the same job vacancies being repeatedly published in the web portals. Apart from those vacancies which are already filled but remain on the job portal, some OJVs are reposted by the employer if the vacancy deadline expires and the post is not filled. Repeated vacancies do not necessarily mean a double entry that needs to be removed. In the latter case, they may simply magnify the need for a certain occupation or skillset and indicate a hard-to-fill post.

Compared to traditional labour market information sources, monitoring real-time data from OJV portals has the most important benefit for policy makers in terms of conveying signals with regard to ongoing trends. Moreover, web-scraped data can provide disaggregated data up to minor occupational groups at the 3-digit level. Real-time data together with a detailed disaggregation of occupational and skill information can improve stakeholders' insights into the functioning of the labour market and form a useful tool for making quick policy responses.

Real-time data obtained by web scraping may improve and hasten the process of skills needs identification and provide information on skills shortages and demand with regard to certain occupations. In areas such as the IT sector, tasks and occupational standards can quickly become obsolete if not updated regularly. Web scraping OJV reveals a changing pattern of skills needs and sends valuable feedback to labour market policy makers,

labour market entrants and educational and training institutions. Policy makers can respond quickly and prioritise the skills and occupations that are most in demand.

Having accurate downloaded web data relies on the quality of the data entry operators. If not coded properly, mistakes may lead to limitations in the usefulness of the data and potential errors. Inconsistent data input by operators entering the information on the online job portal and lack of comparable methodologies, mean that the web data scraped and analysed in this study will have certain limitations linked to connecting occupations/skills with location (geographical area), time, repeat advertisements and the NACE Rev. 2 sector. For example, the analysis of occupations and skills needs on a regional or local level is not possible because of the data input methodology employed by job portals.

Having a better data registry system could significantly increase the effectiveness and comparability of data. If data entry in online job portals followed some basic rules – for example, introducing ISCO occupations, using ESCO libraries for skills and qualifications, properly entering job location, time and NACE sector – this would produce a more useful and relevant dataset for analysis. Despite the existence of national occupational standards since 2016, North Macedonia does not have a library with which to classify skills and qualifications and ESCO could be used to ensure data consistency and comparability, as practised by Cedefop. This would require cooperation with online job portals and training the staff who collect, classify and publish vacancies. However, most of the online job portals in North Macedonia generate revenue from company adverts and it would be expensive for these companies to hire personnel to check the quality and consistency of the data entered.

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Annex 11.1 Codes in Python

```python
# -*- coding: utf-8 -*-
import json
import urllib.request
import xlsxwriter
def get_url(index, size):
    return
f'http://www.najdirabota.com.mk/json/VacanciesHandler.ashx?content=&dateFrom=17%2F08%2F2018&
dateTo=17%2F08%2F2019&area=0&industry=0&employmentOrg=0&position=0&jobType=2&publishers=
0&vacType=0&pageIndex={index}&pageSize={size}&fromPager={index}'
START_URL = 'http://www.najdirabota.com.mk/json/VacanciesHandler.ashx?content=&dateFrom=17%
2F08%2F2018&dateTo=17%2F08%2F2019&area=0&industry=0&employmentOrg=0&position=0&
jobType=2&publishers=0&vacType=0&pageIndex=1&pageSize=10&fromPager=1'
# get resposne as string, using HTTP request
def get_resp(index, size):
# used browser agent header to avoid getting blocked
url = get_url(index, size)
    request = urllib.request.Request(url, headers={'User-Agent': 'Mozilla/5.0'})
    response = urllib.request.urlopen(request).read()
    resp_str = response.decode('utf-8')
    return resp_str
vacancies = []
# get all vacancies, 500 in each request (20 requests in total)
for page_index in range(1, 20):
    r = get_resp(page_index, 500)
    resp = json.loads(r)
    vacancies.extend(resp['listVacancies'])
    print('len', len(vacancies))


print('total vacancies:', len(vacancies))
# order of columns
order = ['position', 'qualifications', 'short_description', 'announceDate', 'applyDeadline', 'areas', 'orgName']


# rows
data = [{'position': i['position'], 'qualifications': i['qualifications'], 'short_description': i['vacancy'],
        'announceDate': i['announceDate'], 'applyDeadline': i['applDeadline'], 'areas': i['areas'],
        'orgName': i['orgName']} for i in vacancies]


# Excel file creation
workbook = xlsxwriter.Workbook('local folder)
worksheet = workbook.add_worksheet('Oglasi')
row, col = 0, 0
# write the header columns (column names)
for header_col in order:
    worksheet.write(row, col, header_col)
    col += 1
row += 1
col = 0
```

```
# Write all data rows in the file
for i, r in enumerate(data):
    for idx, col in enumerate(order):
        worksheet.write(row, idx, r[col])
    # to track execution
    if row % 50 == 0:
        print('wrote row ', row)
    # to write in next row on next iteration
    row += 1
workbook.close()
```

VOCATIONAL EDUCATION AND TRAINING FOR SMART SPECIALISATION: ASSESSING SKILLS IMPLICATIONS IN MOLDOVA AND MONTENEGRO

Pirita Vuorinen and Eva Jansova

This article argues for the need to integrate vocational education and training (VET) and skills analysis within the smart specialisation approach. As higher skills are linked to greater productivity and an enhanced potential for innovation, smart specialisation strategies are likely to be accompanied by a demand for both advanced and medium-level technical skills. This points to an important role for both vocational and higher education and training. To strengthen the skills dimension within smart specialisation, the ETF has developed and tested a methodology for analysing the skills implications of economic prioritisation. This paper outlines some aspects of the methodology and the initial findings of this ongoing work, which began in 2019. The ETF methodological approach seeks to connect VET to the broader drive for innovation, growth and competitiveness. This approach is carried out by assessing skills needs for smart specialisation priorities, at both high and medium levels, as well as the capacities of existing education and training provision to respond to them. The preliminary results of testing this approach in Montenegro and Moldova highlight its limitations in terms of the quality and quantity of the existing evidence for assessing skill needs. Building on these results, the strengthened methodology, including new elements of foresight and peer-to-peer learning will be introduced in a regional context in two pilot regions (Rivne and Kharkiv) in Ukraine in 2020.

12.1 Introduction

The European Commission has a crucial role to play in supporting every region in the EU Member States to activate its potential for innovation, competitiveness, sustainable jobs and growth (European Commission, 2017a). This requires continuous improvements in productivity at both the national and regional levels, and constant adaptation to a changing economic environment. The Cohesion Policy is the Commission's strategy to promote and support harmonious development across EU Member States and their regions. It is also the EU's main investment policy for enabling each region to identify and develop its competitive strengths and economic potential through developing smart specialisation strategies.

Smart specialisation is a place-based approach and is therefore applied primarily at the regional level. Smart specialisation strategies help regions to anticipate, plan and implement their process of economic modernisation (ibid.). They aim to prioritise public investment through a bottom-up approach to the economic transformation of regions and facilitate market opportunities in cross-regional value chains. Through its partnership and bottom-up approach, smart specialisation brings together local authorities, academia, businesses and civil society in working towards the implementation of long-term growth strategies supported by EU funds (European Commission, 2017b).

Since 2011, the European Commission has called on national and regional authorities to develop smart specialisation strategies for research and innovation. In 2014, the smart specialisation approach was integrated into the reformed Cohesion Policy for 2014–20, to maximise the positive impact on growth and jobs. In the European Regional Development Fund (ERDF), specifically under strengthening research, technological development and innovation,

smart specialisation was listed among investment priorities.

Within the Cohesion Policy, more than EUR 40 billion (and more than EUR 65 billion including national co-financing) was allocated to regions through the ERDF to fund these priorities in the period 2014–20 (JRC, 2019a). In addition, EUR 1.8 billion has been earmarked under the European Social Fund for strengthening human capital in research, technological development and innovation (European Commission, 2017a). Following the success of this approach, the European Parliament, the Council of the European Union and the Committee of the Regions have highlighted the need to continue in this vein to raise the innovation potential of all the regions (ibid.).

Today the smart specialisation approach is recognised as a strategic approach to increasing evidence-based public investment in order to foster growth and competitiveness at the regional level and improve citizens' well-being. For the Multiannual Financial Framework 2021–27, the Commission considers modernising the Cohesion Policy and creating an Interregional Innovative Investments component to further strengthen interregional and cross-border cooperation. The tentative budget of EUR 970 million would aim to support regions with matching smart specialisation priorities to build pan-European clusters based on complementarities and synergies in key sectors such as big data, circular economy, advanced manufacturing or cybersecurity

As a result of its success, the European Commission has been sharing the benefits of the smart specialisation approach beyond EU borders, where, despite different framework conditions, it is seen as having potential for promoting decentralised and innovation-led economic transformation as well as fostering interregional and cross-border partnerships. VET and skills development have been recognised as framework conditions for innovation ecosystems. They are already partially reflected in the tools and methodologies that guide the design of smart specialisation strategies in the ETF partner countries. However, to fully connect VET to the broader drive for innovation, growth and competitiveness, in 2019 the ETF started to develop and test a practical guide for analysing the skills implications of smart specialisation strategies. Building on the lessons learnt from the two pilot studies, in 2020 the ETF strengthened and added to the methodology, with a view to adapting it to the regional context. To complete the analysis of skills supply and demand, in 2021 the ETF will add a foresight action to the methodology to sketch out the possible future development paths for education and training, as a result of smart specialisation. In

addition, a partnership-based approach – where VET providers are paired up with a centre of vocational excellence in the EU with matching priority areas for smart specialisation – will be tested to use the information on future perspectives for peer learning.

12.1.1 The concept of smart specialisation

Smart specialisation is an innovative policy approach that aims to boost jobs and growth by enabling each region to identify local strengths and assets, and to develop its own competitive advantages. Key characteristics of smart specialisation include, for example: the place-based dimension, which relates to a strong anchorage in territories; its bottom-up character, nurtured by inclusive dialogue among local authorities, academia, business and civil society (the so-called quadruple helix); the identification of investment priorities based on local assets and resources as a result of an Entrepreneurial Discovery Process; and the flexibility of the mechanism to allow improvements, modifications or reassessments throughout the intervention process (JRC, 2019b).

Since 2011, EU regions and Member States have actively embarked on employing the smart specialisation approach in the context of the European Cohesion Policy. The European Commission has been providing advice to regional and national authorities on how to develop and implement their smart specialisation strategies via a mechanism called the Smart Specialisation Platform. This platform is hosted by the Joint Research Centre's (JRC) Growth and Innovation Directorate (Dir. B) in Seville, Spain, and facilitates mutual learning, data gathering, analysis and networking opportunities for around 170 EU regions and 18 countries (European Commission, 2017b). Between 2014 and 2020, more than 120 smart specialisation strategies have been developed and implemented by Member States and regions in the EU, with an overall budget of almost EUR 67 billion.

Beyond the EU, smart specialisation is practised in many countries and regions around the world. Building on the experiences and achievements of smart specialisation in the EU, since 2016 the JRC has been working with neighbouring countries under the EU Neighbourhood and Enlargement Policy to support methodological reflections around developing smart specialisation strategies (JRC, 2019b). Australia, Brazil, Chile, Colombia, Mexico, Norway and Peru have also adopted the smart specialisation approach to varying degrees. Smart specialisation has further attracted attention in China, the US and Canada, as well as in a number of African countries.

In 2015 the JRC put in place thematic platforms, with the support of several of the European Commission's Directorates-General, to provide an interactive and participatory environment for supporting interregional cooperation in the context of smart specialisation related to the areas of agri-food, energy and industrial modernisation. These platforms are collaborative networks intended to encourage regions and Member States to build coalitions and pool resources on the basis of matching smart specialisation priorities. Today nearly 200 regions and over 25 countries from within and beyond the EU are active on the Smart Specialisation Platform. Smart specialisation has become an engine for interregional and cross-border partnerships in fields such as industrial modernisation, digitalisation, energy transition and agri-food. Expected achievements by 2020 include bringing 15 000 new products to market, alongside creating 140 000 new start-ups and 350 000 new jobs (JRC, 2019b). These platforms have the ultimate goal of establishing European ecosystems for transnational and interregional collaboration in regions and countries with similar or complementary skills for smart specialisation priorities (JRC, 2020).

The JRC has been providing guidance and assistance to the Enlargement and Neighbourhood countries on the development of smart specialisation strategies since 2013. In 2018 it published a report, *Supporting an Innovation Agenda for the Western Balkans: tools and methodologies*, which offers guidance on the diagnosis of the economic, scientific and innovative potential of countries and regions. In this report the JRC (2018)

draws attention to the specificities in transition and developing countries, stating that 'main sources of innovation are not R&D and technology-based but more connected with managerial skills and processes and organisational innovation', and further noting that 'investments in physical infrastructure must be accompanied by technological upgrading, skills-development and new management techniques within broader strategic objectives to have a significant effect'. In order to guide the process of developing smart specialisation strategies, the report provides a smart specialisation framework for Enlargement and Neighbourhood countries that details the process to follow. Table 12.1 provides a summary of this framework.

In the framework, VET is part of the quantitative analysis (stage 3) with an indicator on the number of students/graduates at vocational schools. However, more extensive analysis of both quantitative and qualitative data would be useful in anchoring the strategy in a realistic supply of relevant skills at both medium and high levels. The flexibility in supplying relevant human capital and workforce retraining for the private sector is directly linked to companies' ability to drive and adapt to change – and therefore to achieving the strategic priorities set in smart specialisation strategies.

The ETF believes that to ensure relevant planning for and supply of VET, the smart specialisation process would benefit from quantitative (stage 3) and qualitative (stage 4) analyses in terms of workforce and small and medium-sized enterprises (SME) skills. Also, involving VET actors in the mechanism for stakeholder dialogue (stage 5)

Table 12.1. Summary of the smart specialisation framework for the EU Enlargement and Neighbourhood countries

PHASE	STAGE OF THE PROCESS
Institutional capacity	Decision to start smart specialisation process
	Analysis of strategic mandates
Diagnosis (mapping exercise)	Analysis of existing economic, scientific and innovative potential (quantitative)
	In-depth analysis of priority domains (qualitative)
Stakeholder dialogue	Entrepreneurial discovery process
Institutional capacity for implementation	Design of monitoring, implementation and financing system
Final strategy	Preparation of skills for smart specialisation strategy document

Source: Developed by Pirita Vuorinen from https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/supporting-innovation-agenda-western-balkans-tools-and-methodologies

would further foster inclusive dialogue within the process. Consequently, the ETF sees a role for VET actors in the governance mechanisms for smart specialisation.

12.1.2 The theoretical link between VET and smart specialisation

International trade has persistently affected the distribution of populations, skills and technologies in the world economy (Galor and Mountford, 2001), and has been a significant force behind diverging per capita income across countries. This situation has given rise to fundamental questions about the growth process as well as the role of human capital and its implications for current and historical development patterns.

In industrial economies the process of industrialisation was associated with the growth of manufacturing, the migration of labour from traditional to modern sectors, and technological advances becoming more frequent and widespread (Veselov and Yarkin, 2015). The expansion of international trade increased levels of specialisation in the production of industrial, skills-intensive, goods. The market signals motivated the acquisition of skills, reflecting their complementarity with physical capital and technology. The associated rise in the demand for skilled labour prompted a gradual investment in the quality of the workforce, stimulating technological progress and further enhancing the comparative advantages in producing skills-intensive goods (Galor and Mountford, 2001).

In non-industrial economies, by contrast, international trade generated an incentive to specialise in the production of unskilled, labour-intensive, non-industrial goods (Aghion and Durlauf, 2005). The absence of significant demand for human capital meant there were limited incentives to invest in human capital (Galor and Mountford, 2001). As a result, the demographic transition in non-industrial economies was delayed, further increasing the relative abundance of unskilled labour, magnifying such countries' comparative disadvantage in the production of skilled intensive goods and slowing the course of their development (Aghion and Durlauf, 2005).

The human capital theory typically argues that workers who increase their human capital, through further education and training, contribute to the quantity and quality of goods and services produced as well as enhancing their own value in the labour market (Becker, 1964). Higher skills are also connected with the ability to perform more complex tasks (Green, 2013). Greater functional flexibility and accumulated knowledge mean that highly skilled workers are more capable and faster when it comes to acquiring new areas of expertise and adapting to the structural changes associated with innovation (Toner, 2011). Higher skills thus contribute to greater productivity and increased potential for innovation and creativity (Mason et al., 2017; Hanushek and Woessmann, 2015). This is further connected to positive economic developments that build on the interplay between new knowledge and skills, contributing to technological progress and economic growth. Hence, diversification and innovation promoted through smart specialisation are likely to be accompanied by the need for high level or upper intermediate (technical) skills to support the development of the selected strategic areas.

Within this framework, this article explains the preliminary methodology that has been developed by the ETF and piloted in Montenegro and Moldova. The aim here is to uncover what skills are needed to implement smart specialisation strategies and to what extent the existing evidence in these countries can provide the answers. The article also presents selected findings and challenges encountered during the pilot phase. The ETF has further revised and improved this methodological approach throughout 2020 and adapted it to the regional context, while testing it in two pilot regions in Ukraine. The complete methodology, final outcomes and lessons learnt will be published in 2021 in a full report, incorporating the country cases, main conclusions and recommendations.

12.2 ETF methodological approach

The ETF's goal is to provide a methodological approach for VET policy makers in partner countries to assess the skills implications of economic prioritisation resulting from smart specialisation, and to connect VET and skills provision to the broader drive for innovation. To develop a valid and usable methodology, it was tested to ensure that the tools are appropriate to the requirements of the exercise. The complete methodological approach, to be published in 2021, is more than a set of research methods – it also embraces the theoretical and contextual perspectives underlying the analysis, along with a justification for using the chosen approach.

The key starting point was the national smart specialisation process, along with the relevant analysis available at the time. The national smart specialisation process analysis, conducted in line with the JRC methodology, indicated priority areas based on their innovation potential, as well as identified the main relevant stakeholders for each priority area. Building on this, the ETF methodology

enriched the analysis by exploring the implications of economic prioritisation for VET and skills. For the purposes of this article, VET here includes both initial and continuing VET. Initial VET is designed to 'equip young learners with skills directly relevant to evolving labour markets', while continuing VET aims to provide structures through which 'adults can update their skills and competences' (European Commission, 2010). The former is delivered within the initial education system and can include post-secondary VET. The latter may encompass any kind of education (general, specialised or vocational, formal, non-formal, informal, etc.) and is defined as education or training 'after initial education and training, for professional or personal purposes' (Cedefop, 2014).

The ETF methodological approach builds on policy setting in the area of VET and continuing education and the institutional arrangements for engaging representatives of non-state actors in education and training (i.e. sectoral committees or similar collaborative formats), as well as on existing country evidence (e.g. both administrative or survey data regularly collected in the countries) to develop a methodology that could be extended to and replicated in other countries and regions.

As presented in Figure 12.1, the ETF methodology integrates the assessment of skills demand, analysis of skills trends and gaps, the relatedness of skills, mapping of the training offer and analysis of

training providers' capacities in terms of responding to emerging trends or new skills requirements.

The preliminary methodological approach tested in the pilot countries consists of three modules.

1. Module 1 – Skills assessment for selected priority areas: This aims to analyse the characteristics of the priority areas in terms of occupations, level of qualifications and skills profiles, the incidence of mismatch, trends in wages, etc.
2. Module 2 – Relatedness of qualifications, occupations and skills (QOS): The goal here is to assess the relatedness of QOS in the selected priority areas for growth and smart specialisation (sectors/sub-sectors) with similar/compatible QOS in shrinking economic areas, in order to identify possible alternative uses of skills.
3. Module 3 – Assessment and anticipation of the training offer and training needs for selected sub-sectors: This module is intended to map the existing education and training offer, both initial and continuing, relevant to the selected priority areas and gauge the extent to which it can respond to skills gaps and identified needs.

The methodological approach provides a tool for gaining an understanding of the priority area for smart specialisation in terms of employment and VET provision. Based on the testing of the approach in the two pilot countries, the methodological

Figure 12.1. Human capital for innovation, growth and competitiveness scheme
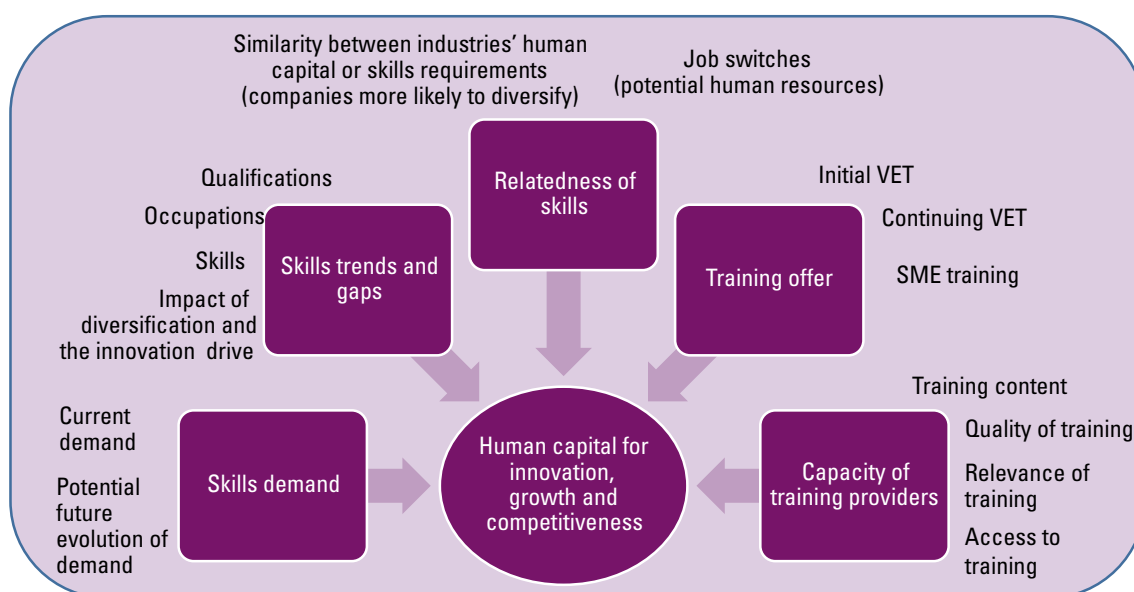
Source: Developed by Pirita Vuorinen.

Figure 12.2. Data sources for the analysis of skills supply and demand

A. Standard statistics

Labour force surveys
PES statistics on vacancies and jobseekers
Enterprise statistics
Education statistics
Censuses

B. Skill-specific data

Enterprise skills data
Qualitative data on skills

C. Other data sources

Projections of labour demand
International databases

Source: Developed by Eva Jansova.

approach will be further strengthened by two additional elements in 2020. First, a component of cross-border peer-to-peer learning partnerships (with possible expansion to the internationalisation of VET) will be added to explore and exchange information on commendable and innovative practices in VET and skills provision in the smart specialisation priority area. Secondly, a foresight exercise to complement the quantitative analysis (long-term needs) will be integrated into the methodological approach.

This article focuses on Module 1 of the methodological approach, which addresses the evidence gathered on employment characteristics, including skills needs assessment, for one priority area per pilot country. The methodology does not seek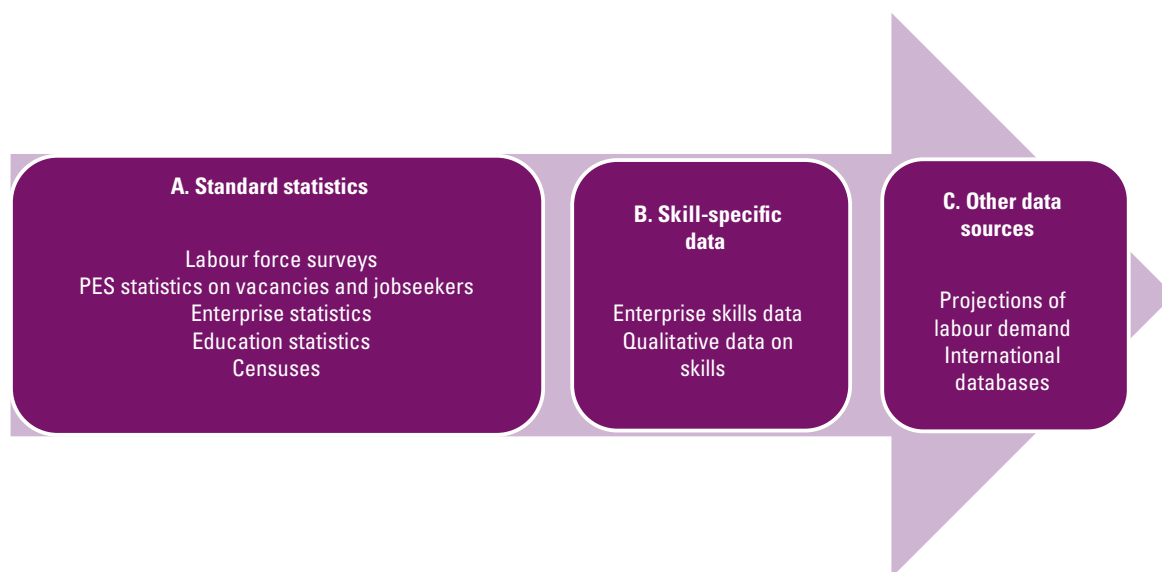 to provide information on the volume of employment, occupations or skills, but rather on the type of skills that are needed when supporting emerging priority areas under smart specialisation.

12.2.1 Data and sources

The analysis relevant for Module 1 combines secondary data analysis, qualitative interviews with relevant stakeholders and desk research. The primary aim of the analysis is to look at existing data sources, test to what extent they can help in reaching the key objectives of the analysis, and form an understanding of the data's limitations.

In terms of quantitative data, the analysis uses statistics from both surveys and administrative data sources, which are usually managed by different institutions, such as the statistical office or ministries or agencies in charge of employment, education and other relevant fields (see Figure 12.2)[1].

Depending on data availability, the quantitative analysis focuses on: (1) socio-demographic variables of the working-age population (gender, age); (2) factors relating to labour market status (employed, unemployed, inactive); (3) classification of the employed by occupation (such as the ISCO classification) and by industry/sector (such as ISIC or NACE); (4) employees' level and field of education; (5) workers' wage levels; (6) the participation of adults (aged 25–64) in formal and informal education; and (7) industry and size of the company or place of work, the required qualifications and number of vacancies per position.

Qualitative data is used to enrich quantitative analysis. Such data is collected through in-depth interviews and/or consultations primarily targeted at companies and business/employers' associations as well as representatives of central and local public administration and professional associations related to the respective priority areas.

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[1]   For more information, please refer to the ETF working paper 'Skills for smart specialisation: Montenegro' (forthcoming), which further includes the mapping of existing education and training provision.

12.2.2 Advantages and limitations

The methodological approach provides manifold advantages. First, it repurposes already existing tools by combining and adapting them to predict the impact of smart specialisation strategies on VET and skills needs. Secondly, by relying to a large extent on existing national quantitative data, the approach fosters buy-in and reduces the cost of replicating the exercise by national authorities. Thirdly, it enables identifying skills needs in a timely manner, thereby making it possible to provide rapid, relevant and targeted VET for employers in the priority areas. Fourthly, the approach enables VET policy makers to connect VET funding to the budget for the smart specialisation strategy, which is both a public and a European Commission funding priority. Finally, through matching priority areas, the approach fosters cross-border peer-to-peer learning partnerships as well as the internationalisation of VET and skills development in the priority areas for smart specialisation.

Despite these advantages, the assessment also has some limitations – a crucial one being the availability of data at sub-sectoral levels. In both pilot countries (Moldova and Montenegro), relevant statistics disaggregated by detailed NACE, ISCO and ISCED levels were lacking. Moreover, further disaggregation of data to regional or local levels often leads to unreliable results, while inter- and intra-sectoral transitions of the labour force were also difficult to spot using available statistics.

To overcome these challenges, the methodology uses multiple sources of data as well as various approaches to evaluate the information produced in order to enhance the credibility of the analyses. Assessing value, relevance and comparability is vital; moreover, in-depth qualitative research (interviews and focus groups) are instrumental in gathering more accurate views, reflecting employers' perspectives and obtaining specialist assessments on skills demand and their evolution in the priority sectors. To gain valuable insights and information, it is necessary to have access to the relevant stakeholders and to receptive public administrative institutions and companies, underpinned by the resources to adequately cover the territory and the sub-sectors involved.

12.3 Results from the pilot countries

The two pilot countries selected for testing the methodological approach, Montenegro and Moldova, are among the first non-EU countries to adopt the smart specialisation approach.

Moldova joined the JRC's Smart Specialisation Platform in 2016, and, under the coordination of the Ministry of Education, is working on developing a national smart specialisation strategy. In Montenegro the development of a smart specialisation strategy began in 2017, following a recommendation from the European Commission to include smart specialisation as part of its EU accession negotiations. The inter-ministerial working group that leads the process is headed by the Ministry of Science. In Montenegro, when the ETF came to test the methodological approach, the final smart specialisation strategy had already been endorsed, while in Moldova only preliminary priority domains for smart specialisation had been identified.

In Moldova, a peer review of the research and innovation system by the Horizon 2020 Policy Support Facility (European Commission, 2016) kick-started the smart specialisation process. The quantitative analysis (stage 3, mapping of economic potential) was implemented and a number of preliminary priority domains identified, such as energy[2], agriculture and food processing, and information and communication technologies. The smart specialisation strategy is expected to be finalised in 2020.

Although the smart specialisation approach in Montenegro was not adopted until 2017, it is the only Enlargement and Neighbourhood country that has so far completed its national smart specialisation strategy (2019–20) and devised an action plan. The priority areas identified in the strategy are sustainable agriculture and food value chain, energy and sustainable environment, and health tourism – with information and communication technology identified as a horizontal priority to support the other fields.

The testing of the methodological approach by the ETF focused on two priority areas in each pilot country, one of which is covered in this article: sustainable and health tourism in Montenegro; and energy, with focus on its sub-sector – renewable energy – in Moldova.

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2   With a focus on renewable energy.

The energy sector in Moldova

Moldova has limited reserves of solid fuel, petroleum and gas, and low hydroelectric potential. This has led to a high dependency on energy imports, mainly from Russia and Ukraine. In addition, the gas infrastructure is underdeveloped, with limited gas storage facilities. As a result, the country is vulnerable to unplanned shortages in gas supply. The existing energy mix favours natural gas, which is now largely supplied through the gas interconnector between Romania and Moldova. In the case of electricity, 80% of the market is dependent on one power station (IEA, 2020). To increase energy security, the government plans to diversify supply through the addition of more renewable energy. There are also proposals to fully synchronise the country's electricity network with the European Network of Transmission System Operators for Electricity (ENTSO-E) and to connect to the European electricity market (Ibid.).

The Ministry of Regional Development and Construction is responsible for the energy sector, while the Energy Efficiency Agency is the administrative authority for energy efficiency and renewable energy. The legal framework for the energy sector was established by the Law on Renewable Energy (2007) and the Law on Energy Efficiency (2010). Until 2020 the policy framework is the responsibility of the National Energy Strategy, complemented by the National Energy Efficiency Programme 2011–20, implemented as part of National Energy Efficiency Action Plan 2017–20 and the National Renewable Energy Action Plan (COR, 2020). A gradual reconciliation of the national legislation with the relevant EU acquis is underway. In 2018 the contribution of the energy sector to the gross value added was 2.9%, and 1.7% of all employees worked in this sector*. The sector is dominated by large enterprises, with 99% of turnover generated by this type of company**.

Within the broader energy sector, renewable energy*** has been identified as an important niche for smart specialisation. The share of renewable energy in the gross final domestic energy consumption has been growing in recent years and reached 27.8% in 2017. Approximately 98% of this share is accounted for by biomass (IRENA, 2019), the primary source of renewable energy in Moldova. The importance of biomass, in the form of agricultural residues and wood, is a result of the strong role of agriculture in the country. Biomass fuel is predominantly consumed for heating in the residential sector. However, biomass is further opening up opportunities for private-sector development, since, based on the European experience, SMEs dominate production and the supply chain in this area. Moreover, with the global demand for biomass rising, important prospects are emerging for SME internationalisation. At present Moldova is only just beginning to harness the potential of renewable energy. The state has initiated different schemes to support the development of renewable energy sources, with a target of at least 100MW to be installed by 202****. The state is also attracting external funding to increase energy efficiency, for example the EBRD-funded MOSEFF project, which has allocated EUR 42 million for more than 300 projects*****.

With respect to other sources of renewable energy, there is only one operational hydropower plant and two industrial wind installations. In the case of solar energy, Decision No 321, passed in 2009, concerns the tariff methodology, and a limited number of generating units have been built on the roofs of both private and public buildings since then (IEA, 2020).

* NBS (https://statbank.statistica.md, last accessed 4 May 2020);
data refer to the economic sector of electricity, gas, steam and air conditioning supply.

** Large enterprises are those that have 250 or more employees, achieve
an annual turnover of more than MDL 50 million or have total assets of more than MDL 50 million.

*** The renewable energy priority area covers the generation, collection or transmission of energy
from renewable sources, such as wind, solar technologies, biomass, hydro and geothermal energy.

**** Law No 10 of 26 February 2016 on Promotion of the Use of Energy from Renewable Sources,
http://lex.justice.md/md/363886

***** European Portal for Energy Efficiency in Buildings,
www.buildup.eu/en/explore/links/Moldovan-sustainable-energy-financing-facility-MoSEFFMoldova

12.3.1 Employment and skills: smart specialisation in energy (renewable energy) in Moldova

This section provides selected information taken from the pilot study implemented in Moldova. While the smart specialisation approach was still ongoing in the country during the ETF analysis, preliminary priority areas had been identified and were used for the analysis. The study covered the energy sector, highlighted as one of the preliminary priority areas, and three potential sub-priority areas were further identified: heating solutions; efficient technologies; and alternative energy sources (i.e. renewable energy).

As seen from the methodology, the analysis relied on a combination of existing quantitative data, evidence collected through qualitative interviews as well as existing (international) research on skills in the energy sector. As detailed reliable quantitative data are often unavailable, the primary focus was on data related to the sub-sector of electricity, gas, steam and air conditioning supply. The preliminary discussion on skills implications then focuses on the area of renewable energy, one of the key sub-areas that was identified as a possible strategical niche for development.

Based on the existing quantitative data the energy priority area can be characterised by a declining number of employees (see Figure 12.3)[3]. The energy sector is also dominated by large companies, which, in 2018, employed 95 % of the workers in the energy industry[4].

At the same time, the monthly net salary within the energy sub-sector is higher than the average salary across all economic activities and has been increasing over recent years (see Table 12.2). Between 2014 and 2018, the average monthly net salary rose by 49 %.

When it comes to labour demand, the number of vacancies has been stable over recent years. According to the National Bureau of Statistics (NBS) data, the number of vacancies within the sector of electricity, gas, steam and air conditioning supply was 475 at the end of 2015 and 470 at the end of 2019[5].

The existing data do not allow a detailed analysis of occupational or educational profiles of the workforce in the priority area. Yet, assuming a positive correlation between skills (qualifications) and salary, we observe that the share of high-earning employees is much higher in the priority area compared with the overall distribution across all economic activities, with 48% of employees in the energy sector earning over MDL 10 000 a month, in contrast to 16% across all economic activities[6]. Consequently, this suggests that employment in the energy sector is significantly skewed towards highly skilled workers. This proposition is also supported by the interviews with employers, who confirm that the preliminary priority area of energy requires specialised personnel with high and/or medium levels of skills. This means that employees are usually required to have completed tertiary education, typically related to the field of engineering.

Interviewed employers stated that the demand for workers, both high- and medium-skilled, currently exceeds supply. In particular, the replacement of highly skilled workers is a major issue for this sector. Companies often need to invest in training for their staff to augment their existing knowledge and abilities, mostly in the areas of computer skills or foreign languages, especially English.

In general, the following competences were identified during the interviews as particularly relevant for this priority area:

- technical competences (general understanding of the field, with emphasis on engineering skills; specialists are expected to install, maintain, test and monitor the energy generation systems);
- language competences (a knowledge of foreign languages, especially the ability to understand and communicate in English);
- digital competences (from basic ICT literacy and the ability to manage and analyse data to the management of IT systems and operational technology);
- generic competences (analytical and problem-solving skills, critical and innovative thinking, work ethics, the motivation to learn, the ability to work with others and resilience).

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[3]   Quantitative data used for Moldova do not include information on districts from the left side of the river Nistru and the municipality of Bender.
[4]   Authors' calculation based on NBS data (https://statbank.statistica.md, last accessed 4 May 2020).
[5]   NBS (https://statbank.statistica.md, last accessed 4 May 2020).

[6]   Authors' calculation based on NBS data (https://statbank.statistica.md, last accessed 4 May 2020).

Sustainable and health tourism in Montenegro

Montenegro is one of the fastest growing tourism destinations in Europe and its macro-economic activity is primarily based on services related to hotels, restaurants and other similar tourist facilities. The economy's reliance on its tourism sector is reflected by the fact that this area employs 15% of the workforce and provides one-fifth of the country's gross value added (European Commission, 2018). The importance of tourism is continuously growing, which has a positive spillover effect on other industries, such as agriculture, construction, trade and transport. Ongoing infrastructure improvements such as the completion of the priority section of the Bar-Boljare highway, connecting the Adriatic port of Bar with Serbia, is expected to further support Montenegro's tourism industry (EBRD, 2017).

One of the main characteristics of the tourism industry in Montenegro is its seasonal nature. The new smart specialisation strategy has identified the potential to extend the tourism sector from summer to off-peak and year-round tourism by developing sustainable and health tourism. In 2018, based on the report of the European Health Consumer Index, the Montenegrin health system was placed 23rd in Europe, well ahead of many EU Member States. The costs of health services in the country are relatively low, making this industry highly suitable for development. The Health Insurance Fund of Montenegro has concluded agreements on the provision of health services with 23 European countries (Ministry of Science, 2018). According to the estimates of the World Travel and Tourism Council, in the next 10-year period, the total contribution of tourism to GDP is expected to grow at a rate of 3.9% on average per year (ibid.).

Currently the health tourism offer is concentrated mainly within the Institute Simo Milosevic in Igalo, and the hospitals in Risan and Meljine, as well as in the country's 4 and 5-star hotels (mainly through spa and wellness offers). The aim in cultivating sustainable and health tourism is two-fold: developing new and improving the existing tourist and medical capacities (services for respiratory and heart-related diseases, physiotherapy, aesthetic surgery or spa and wellness treatments); and introducing innovative technologies in the field of sustainable and health tourism (strategy for health tourism).

To support this smart specialisation priority, Montenegro established a health tourism cluster in 2015 to connect leading experts from both the health and tourism sectors to promote the health tourism offer. Moreover, the Coordination Committee for Health Tourism was set up in 2016 as part of the Chamber of Economy of Montenegro to develop and coordinate the relevant services. In addition, the country has developed a strategy in cooperation with different public and private stakeholders to define further directions for the development of this sub-sector by 2022. Montenegro's Strategy for the Development of Micro, Small and Medium-Sized Enterprises 2018–22 includes provisions for supporting vertical clusters in the tourism sector, and linking them to scientific research institutions (Ministry of Economy, 2018). However, several key companies in the sector remain publicly owned despite their envisaged privatisation (2017 Privatisation Plan) (EBRD, 2017), and their privileged access to financing in spite of substandard performance creates market distortions and an uneven playing field for private enterprises, especially SMEs (OECD, 2018).

Figure 12.3. Number of employees in electricity, gas, steam and air conditioning supply

2014	2015	2016	2017	2018
11 914	11 665	11 119	10 930	10 627
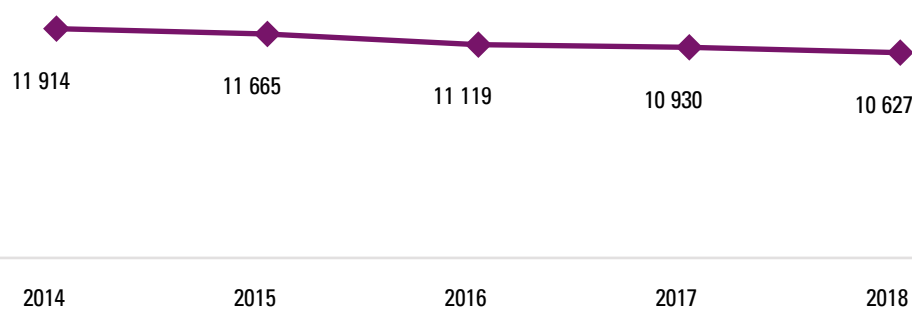
Source: NBS (https://statbank.statistica.md, last accessed 4 May 2020).

Table 12.2. Average monthly net salary in the energy sector compared to overall real-sector wages (in MDL)

	2014	2015	2016	2017	2018
Production and supply of electricity, heat, gas, hot water and air conditioning	5 833.3	6 536.7	7 094.8	8 023.3	8 707.6
All economic activities	3 398.9	3 751.6	4 102.8	4 563.9	5 141.9

Note: Data include real sector economic units with one or more employees and all institutions in the budgetary sector.

Source: NBS (https://statbank.statistica.md, last accessed 4 January 2020).

Finally, the main skill gaps identified are characterised by a lack of knowledge of foreign languages, especially among highly skilled workers, and poor analytical and problem-solving skills, as well as low motivation to learn new things in the case of medium-skilled workers. In addition, (advanced) IT skills are increasingly required due to the growing use of new technologies.

When it comes to renewable energy technologies, the evidence collected from the interviews points to a general lack of specialists, which can impact on the growth prospects of the priority area. The development of the renewable energy sub-sector accelerates the pace of change in terms of skills demand and raises new expectations from VET and higher education providers, whether in the areas of solar, wind, hydro or biomass. These processes alter the skills requirements within existing occupations, giving rise to new qualification and skills needs.

Supporting and developing the preliminary priority area of energy, and its sub-sector renewable energy in particular, requires specific knowledge at different levels. From international experience, it is evident that the expertise needed in the area of renewable energy calls for new specialised profiles and, building on 'traditional' competencies, supplementary targeted knowledge and skills. This means that training in the workplace is key. Therefore, not only the formal education sector, but also employers need to respond to the need for continuing professional training.

Generally, in the energy sector, the required skills cover the various steps involved in production, such as equipment manufacture and distribution, project development, construction and installation, operation and maintenance, biomass production and cross-cutting occupations.

Focusing, for example, on solar energy, typically three occupational groups are engaged in this field: workers responsible for building and maintaining solar installations; sales staff; and high-skilled software and electrical engineers. Typical jobs would thus be solar installer, sales consultant, electrician, project manager, electrical engineer, field service technician, maintenance technician, construction manager, project engineer or software engineer.

New profiles are emerging in the renewable energy sub-sector. In general, these are connected with projecting, manufacturing and operating renewable energy technologies. Thus, for example, there is a need for wind/solar power design engineers, resource assessment specialists and technicians in renewable energy services. Furthermore, additional competencies in existing jobs are also required – for example, in the case of electricians and plumbers who install small-scale renewable technologies (EU Skills Panorama, 2014). Among generic skills, team working and communication skills are key. In addition, staff in technical roles are also expected to have good problem-solving and decision-making skills, and are required to assess and monitor procedures, diagnose problems and provide solutions (Baruah et al., 2018). This also applies in the case of Moldova, where the supply of skilled workers at each stage of the production process needs to be ensured if renewable energy is to be prioritised in the context of smart specialisation. Although relevant education programmes exist at secondary, post-secondary and tertiary levels in Moldova, the offer related to renewable energy is very limited and concentrated mainly at the tertiary level[7].

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7   For more information, please refer to the ETF working paper 'Skills for smart specialisation: Moldova' (forthcoming), which further includes the mapping of existing education and training provision.

The preliminary profiles listed below were identified as the most important if renewables are to be focused on within the smart specialisation strategy, and should thus be prioritised in the education and training offer.

- Tertiary education qualifications:
  - wind/solar power design engineers;
  - wind/solar resource assessment specialists;
  - biomass production managers.
- Secondary/post-secondary education qualifications:
  - wind/solar service mechatronics technicians;
  - electricians, plumbers, roofers and construction workers specialising in solar, wind and bioenergy.

12.3.2 Employment and skills: smart specialisation in sustainable and health tourism in Montenegro

As above, this section provides selected information from the pilot study implemented in Montenegro. At the time of the ETF analysis, the national Smart Specialisation Strategy was undergoing validation. Thus, as opposed to Moldova, the final priority areas for smart specialisation had already been identified. The analysis covered the preliminary priority area on sustainable and health tourism, focusing on the latter aspect – health tourism.

The analysis of smart specialisation in health tourism explored the possibilities offered by the existing quantitative evidence, which was complemented by a number of qualitative interviews. In terms of the quantitative data, the primary focus was on two relevant economic activities: hotels and similar accommodation (at sector level), on one side; and

accommodation with medical care, on the other side (at sub-sector level).

The quantitative evidence shows that the number of employees at sectoral level has been gradually increasing in recent years (see Figure 12.4). However, when it comes to the accommodation with medical care, a significant decrease was registered in 2015, where the number of employees was more than eight times lower compared to the last available data from 2012. According to Monstat, a possible explanation for this drop is changes introduced in the classification of businesses.

In terms of wages, a positive trend can be seen in salaries in recent years (see Figure 12.5). In 2018 the average monthly net salary in the sub-sector 'accommodation with medical care' was EUR 458, which is slightly below the average salary in Montenegro. Unfortunately, the existing data does not allow for further analysis of the sub-sector in terms of occupation and education profiles.

Based on the interviews with employers, it can be concluded that there is currently a sufficient supply of skilled workforce in the area of health. The existing occupations are concentrated in the groups of professionals, technicians, associate professionals and sales and service workers. Many hotels and related facilities also offer spa and wellness services, which are considered to be among those with the highest potential for the development of health tourism. In the case of tourism, the country relies on foreign workers. The quality and quantity of the workforce is conditioned by its seasonal nature and high staff turnover.

Figure 12.4. Number of employees at the sectoral and sub-sectoral level
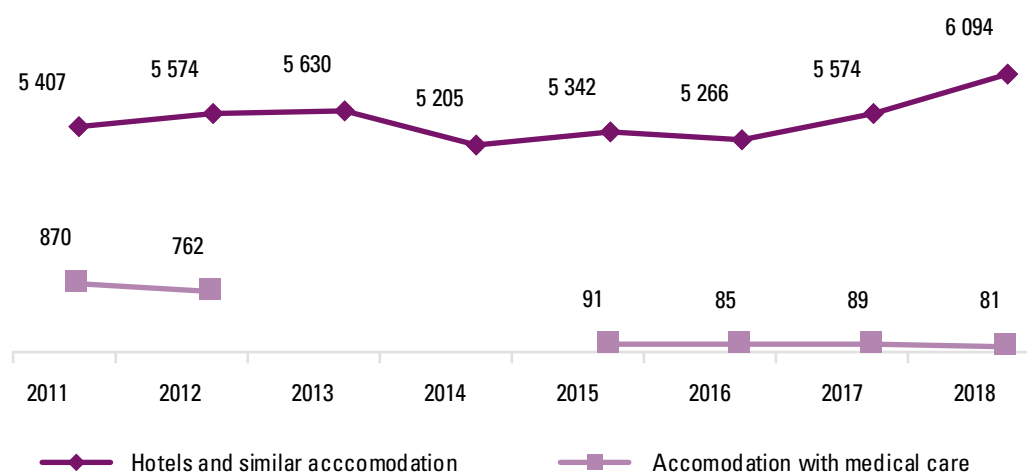
Source: Monstat, labour force survey.

Figure 12.5. Average monthly net salary in health and tourism (in EUR)

Data labels (upper line — Accomodation with medical care): 403, 409, 409, 419, 445, 430, 572, 472

Data labels (lower line — Hotels and similar acccomodation): 379, 353, 360, 377, 424, 436, 434, 458

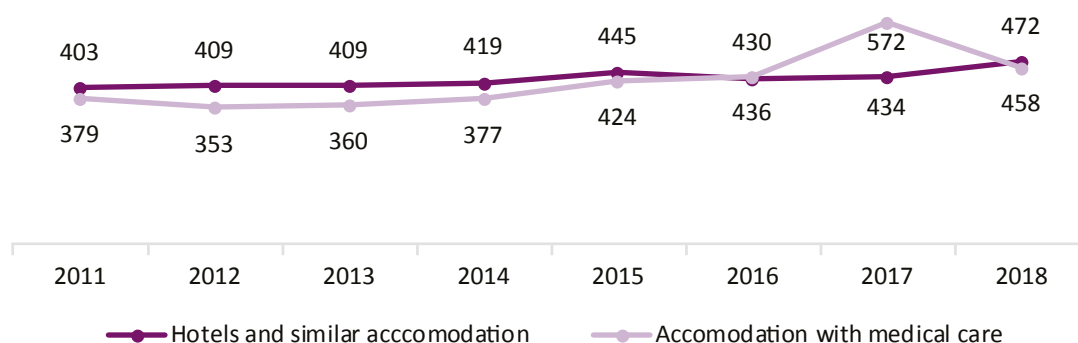X-axis: 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018

Legend: Hotels and similar acccomodation — Accomodation with medical care

Source: Monstat, labour force survey.

To meet the needs of the growing tourism sector, companies have a constant need for skilled and educated employees. This is particularly noted during the summer months within the tourism season (April to October) for various type of wellness and prevention services (such as different kinds of massages, yoga and meditation, weight control programmes), as well as programmes designed for rehabilitation and recovery from various illnesses or injuries. To address skills needs, companies are investing in staff training mainly through in-house training and mentorship programmes. Many companies employ trainers from abroad in areas where the relevant training is not available in Montenegro.

During the qualitative assessment, it was confirmed that within the Montenegrin health tourism area there is a demand for certain technical skills related to, for example, the ability to handle particular equipment and technical/scientific knowledge pertaining to the health services. Besides these technical/professional skills, there is a pressing need for staff with a knowledge of foreign languages, especially English, both oral and written. In addition, digital competencies are important. Finally, a range of soft skills are required, for example: good powers of communication, a service-oriented outlook, presentation skills, team-working abilities, resilience, and time management and planning skills. Teamwork, customer relations, the ability to present the services offered and products used (specific oils, creams, and other cosmetic and self-care products) are becoming increasingly important in this sub-sector. Lack of relevant postgraduate education (Master's level) and PhD studies is considered a limitation.

The findings of the qualitative assessment are confirmed by international experience, which shows that health tourism is built on a wide range of skills across the fields of tourism, hospitality, health, healing, fitness, sport and spirituality. Of key importance in this priority domain are the staff, at both managerial and operational level. At the same time, a great diversity of skills is called for, horizontally as well as vertically. Thus, the required skills for each job vary according to the type and level of service. In addition, workers need to possess the appropriate mix of technical, service and managerial skills (Dvorak et al., 2014).

To boost health tourism, it is important that management and support role positions should also be in place. At this level, although no specific technical knowledge is required, the following competencies are key: presentation, communication and networking skills, sales and marketing expertise, proficiency in human resources management, and the ability to recognise customer expectations and service gaps. In the case of operational staff, they need to have the relevant professional skills for the delivery of health and well-being services or treatments and health procedures, as well as a knowledge of foreign languages and presentation, communication and networking skills (Illing et al., 2013).

Confronting the above with the evidence collected in the country, the following key profiles have been identified as vital in promoting development and innovation in the field of health tourism: specialists in the area of spa and wellness; therapy and fitness professionals; medical experts; support staff; customer service workers; and supervisors.

In addition, there is a need to boost skills related to the marketing and presentation of products and services, foreign languages and digital technology, as well as service orientation, teamwork, resilience and organisational skills.

12.4 Conclusions

This article argues that countries developing smart specialisation strategies should conduct a broader analysis on what this means in terms of skills than that proposed by the JRC's framework for Enlargement and Neighbourhood countries. Successful implementation of smart specialisation strategies requires a relevant and timely supply of skills at all levels – foregrounding the important role of both initial and continuing VET in equipping workers with advanced and technical skills.

This article has presented the ETF methodological approach and preliminary findings from the ongoing pilot studies in Moldova and Montenegro, where smart specialisation was adopted at national level. The evidence suggests that in both countries the researched smart specialisation priorities are subject to skills shortages and gaps that may hamper the performance of companies and therefore compromise the achievement of the set goals. Skills have an important role in enabling companies to raise productivity, adapt to market demand and promote innovation. The power to solve the skill mismatch challenge lies in the hands of employers and education and training providers, as well as the state and individuals.

Given the characteristics of the smart specialisation priorities for health tourism and renewable energy, there are important opportunities to support the development of specific qualifications or programmes within the formal education system, and/or plan additional brief modules within existing programmes, but also to facilitate the up-skilling of the current adult workforce through short-term courses and workplace training. Moreover, measures are needed to support the provision of relevant training, targeting both the workforce and companies in a timely manner.

It is thus crucial to include VET and skills development within the smart specialisation approach. As a result, the ETF has developed a methodology to assess the skills implications of smart specialisation strategies. The analysis aims to rely primarily on existing data sources that are regularly collected in the country and to test the feasibility of the theoretical methodological approach.

The experience in Montenegro and Moldova highlighted various issues, which need to be accounted for during the review of the methodological approach. Having sufficient data at the sub-sectorial level is crucial for VET and skills analysis. Both the Moldovan and Montenegrin experience show that the available statistics are not always sensitive enough to allow disaggregation by detailed NACE, ISCO and ISCED levels.

This is also the case for key labour market surveys, such as labour force surveys or administrative data collected by public employment services.

Moreover, as smart specialisation addresses new domains and specialisations, further disaggregation of data at the regional or local levels, while useful for many other purposes, does not currently capture the localised nature of activities and often leads to unreliable results. Therefore, when it comes to understanding the VET and skills implications of smart specialisation, a mix of quantitative and qualitative approaches is necessary to produce more reliable results. Inter- and intra-sectorial transitions of the labour force are also difficult to spot using available statistics. Without regularly collected data and indicators at the regional and sub-sectorial level, it will be difficult to make plans, track progress towards achieving policy goals, undertake the necessary adjustments in the various policy areas and assess any transformation in the priority domains for smart specialisation.

The revised methodology takes the identified challenges into account and finds ways to overcome them. One approach could be to strengthen the collection of qualitative research data to enrich the quantitative data. Another way forward would be to strengthen the vision-building capacity in VET and skills needs, within the context of smart specialisation, through a foresight exercise and partnership building underpinned by peer-to-peer partnerships.

Finally, there follow some considerations that are important for ensuring VET and skills support for the smart specialisation process. First of all, connecting skills while mapping the potential for innovation and preparing a smart specialisation strategy requires the involvement of all the relevant actors. Creating such a framework challenges existing governance mechanisms and requires rethinking existing coordination and cooperation mechanisms across

both horizontal and vertical levels and among all actors. It also means that representatives of the education sector, in particular those concerned with vocational, higher and adult education at both the national and regional levels, should be integrated into existing governance mechanisms in order to drive the process and inform public investment priorities.

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ARTICLE 13

EMERGING DIGITAL SKILL SHORTAGES AND SKILL MISMATCHES IN THE WESTERN BALKANS: CAN UNIVERSITIES PROVIDE THE HIGH-QUALITY EDUCATION NEEDED FOR THE FUTURE?

William Bartlett

This article provides a review and analysis of the extent and nature of the digital skills gaps and mismatch in the labour markets of the Western Balkan region[1]. It is based on analysis of administrative data on the number of students graduating from information and communication technologies (ICT) study programmes, combined with a forecast of the future shortages that are likely to emerge in this field. It shows that while the demand for labour in the digital economy is growing rapidly, universities are falling behind in equipping students with the appropriate skills for the new digital workplace, leading to a shortage of graduates with relevant ICT qualifications. Without an increase in the provision of university education in ICT study fields and an improvement in its quality, this skill gap is likely to persist in the future. The article also draws on large-scale surveys of both graduates and employers in the Western Balkans which show that graduates experience a difficult transition into the labour market, with insufficient support and guidance provided to assist in them in their job search activities. The surveys also reveal severe skill mismatches among graduate employees with ICT qualifications, who, as a group, show the highest proportion of graduates from any field whose qualifications fall below the level required by the job. The article concludes that universities in the Western Balkans are failing to produce graduates in sufficient numbers or with the high level of skills required by economies that are rapidly adopting new digital technologies. It provides a number of recommendations on how universities and employers could adapt to provide the high-quality digital education needed for the future emerging digital economies.

13.1 Introduction

The digital economy is having a profound effect on the global economy (Mühleisen, 2018). The consensus view is that while new technologies will replace some jobs, others will be created in innovative industries that complement the newly automated sectors (Brynjolfsson and McAfee, 2014; Cedefop, 2018). However, others fear that the new wave of technological innovation will overwhelm the ability of economies to provide sufficient complementary jobs to prevent widespread unemployment (Susskind, 2020).

Despite such anxieties, it is widely accepted that access to broadband internet connectivity increases businesses' propensity to innovate (Bertschek et al., 2013) and that there is a strong link between the expansion of digital connectedness and an economy's productivity and competitiveness (World Bank, 2016; Kelly et al., 2017).

As with other countries around the world, those of the Western Balkans are experiencing profound structural change due to the digitalisation of their economies, and consequently the demand for workers with digital skills is expanding. There are many examples of ways in which the development of broadband infrastructure and high-speed internet access has supported economic growth in the region, from the proliferation of call centres to the development of computer games companies. Yet the Western Balkan countries lag

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[1] The Western Balkan group of countries includes Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia and Serbia, all of which are candidates or potential candidates for EU membership.

behind others in the development of their digital infrastructure (Mitrović, 2015). Compared to an internet penetration rate of 89% of households in the European Union's (EU) in 2018, the rates in the Western Balkans are far lower, ranging from 69% in Bosnia and Herzegovina to 79% in North Macedonia[2]. Moreover, the level of internet skills in the Western Balkans is generally below that found in the EU. According to a 2019 survey conducted by Eurostat, only 20% of individuals in Serbia have above basic digital skills, with the equivalent proportions elsewhere in the region recorded as only 15% in North Macedonia, 14% in Kosovo[3] and 8% in Bosnia and Herzegovina. In comparison, the proportion of people with above basic digital skills is 38% in the EU-28 and 35% in Croatia. While all levels of the education systems in the region are trailing other countries in the provision of digital skills, weaknesses in the teaching of such skills in the higher education sector is particularly worrying, with employers reporting severe skill gaps among recent university graduates (Bartlett and Uvalić, 2018). Following the economic crisis of 2009–14, unemployment rates increased, and so for a while these skill gaps did not impose a serious constraint on growth. However, an economic recovery has been underway since 2015 and the demand for university graduates with ICT qualifications is beginning to outstrip the available supply. In Serbia, the Foreign Investors Council's White Book (2019, p. 64) explains that: '[…] not many colleges are capable of providing their students with practical knowledge. As a consequence, companies are forced to invest significant resources in training new employees.' In other words, the skills gaps and mismatches in the area of digital technology may soon impose a severe constraint on economic growth in the region, if they have not done so already.

It is not surprising, therefore, that the provision of digital skills has rapidly moved up the region's policy agenda. The EU's Strategy for the Western Balkans sets out a Digital Agenda for the region as one of its flagship policy initiatives (European Commission, 2018a; 2018b). This aims to promote the development of the digital economy by supporting broadband connectivity and enhancing digital skills to enable economic growth[4]. In addition, the Western Balkans Investment Framework is financing the digital economy, and the EU has allocated EUR 30 million to digital projects in the region[5]. The emphasis on the digital economy is also a key feature of the plan to create a Regional Economic Area, which has been developed within a major policy initiative for regional economic development known as the Berlin Process and is managed under the auspices of the Regional Cooperation Council (RCC and CEFTA, 2018). The digital dimension of this plan covers broadband deployment and aims to promote digital skills throughout the region.

This article measures the gap between the demand for and supply of university graduates with ICT skills, discusses the quality of education in this field of study, and identifies the extent of skill mismatch in digital jobs. Graduate employment has increased rapidly in recent years due to the economic recovery that has taken place since 2015. Even before then, graduate employment was rising as the demand for workers with digital skills grew in response to structural change. The evidence for this development was presented in a study funded by the European Commission and published in 2016 (Bartlett et al., 2016). The research was based on an internet survey of 4 600 higher education graduates in the six Western Balkan countries carried out in 2014–15, alongside a survey of over one thousand employers of higher education graduates. The graduate survey covered graduates within five years of graduation from an institution of higher education throughout the Western Balkans. The survey respondents were distributed across all levels of higher education[6].

The distribution of respondents across various fields of study achieved a good representation of the population of university students, as revealed by the administrative data collected from national statistical offices on the range of study programmes and the population of students in the region. For example, 7% of respondents had a qualification in ICT study fields, compared to 5% of all graduates in the academic year 2013/14. The surveys were complemented by semi-structured interviews with almost one hundred stakeholders, including higher education policy makers, university professors and managers, and a range of labour

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[2] Eurostat online data.
[3] This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence – hereinafter 'Kosovo'.
[4] The digital economy concept includes e-business infrastructure (hardware, software, networks, human capital), e-business (ways of conducting business, processes) and e-commerce (online transfer of goods).

[5] Some examples include the integration of the Western Balkans into the EU's Code Week Initiative, and the British Council's programme, within the Berlin Process, to upgrade the teaching of coding skills in all primary schools in the region.
[6] The distribution of the degree level of respondents was as follows: 9.4% held a vocational diploma, 46% held a Bachelor's degree, 7.9% held a professional ('specialist') degree, 33.4% held a Master's degree and 1.1% held a doctoral degree.

market stakeholders (see Bartlett et al., 2016, for further details)[7]. The employer survey sample was taken from the population of public and private organisations that employ graduates, covering 1 074 employers of 31 990 graduates throughout the region. The sample included organisations of all sizes, from micro (employing fewer than 10 workers) to large (employing 250 or more). Almost two-thirds of graduates covered by the survey were employed in large organisations and over a quarter were employed in medium-sized organisations.

Section 13.2 considers the supply of digital skills from the higher education (university) sector in the Western Balkans and analyses the quality of course provision in ICT study fields. Section 13.3 analyses the graduate labour market in the region and identifies the fast growth of demand for skilled labour in the ICT sector in the region. Section 13.4 brings the two sides of the market together and provides an analysis and forecast of skill gaps in the form of excess demand for graduate employees with qualifications in ICT. Section 13.5 analyses the skill mismatches of graduate employees with qualifications in ICT subjects in comparison to other fields of study. Section 13.6 summarises the arguments and offers a number of policy recommendations.

13.2 Higher education and the supply of digital skills

In 2015, there were 240 universities and other higher education institutions in the Western Balkans, organised into 586 specialised faculties (Bartlett et al., 2016). Alongside the public universities, numerous private institutions have been created in each country of the region. Data collected from national statistical offices and ministries of education demonstrated that universities in the region provide over 5 000 study programmes at all levels, with almost half offering Bachelor's degrees and almost two-fifths Master's qualifications. About half of all study programmes are in the Humanities and social sciences (HSS) group of subjects, among which those in the 'Business, administration and law' fields are the most numerous, with a further significant concentration of courses in 'Arts and humanities'. The Science, technology, engineering and mathematics (STEM) group of study programmes account for more than one quarter of all courses, ranging from 20% in Albania to 36% in Serbia. The most popular of these are in 'Engineering, manufacturing and

construction'. Relatively few students follow ICT study programmes; in 2015, only 6.6% of university courses covered these subjects.

University enrolment and completion of studies broadly follow the patterns of the study programmes. Over half of students graduated in HSS subjects in 2013/14, while only one quarter of students graduated in STEM subjects (see Table 13.1). This is similar to the EU-28, where 45% of graduates study HSS subjects and 25% take STEM courses[8]. Detailed data by field of study, such as the figures given in Table 13.1, are not published by the national statistical offices. However, the broad picture is unlikely to have changed significantly since 2013/14. The Statistical Office of the Republic of Serbia published data on graduate completions for 2017, showing that the proportions of students by field of study were little changed. For example, the share of students completing studies in ICT was 5.5% in the academic year 2013/14 and 5.8% in 2017/18, a tiny increase[9]. By type of qualification, about three-fifths (62.5%) of the students in the Western Balkans studying ICT completed their studies at Bachelor's degree level, while more than one third (35.9%) completed their studies at Master's level. A trivial proportion (0.6%) completed doctoral-level courses.

In 2013/14, total annual university enrolments throughout the region were almost twice as high as annual completions, while the completion ratio (the ratio between enrolments and completions in a given year) was 53%. The completion ratio in the field of information and communication studies was similarly low. In Serbia, for example, the completion ratio for this field of study was just 56.4% in 2017[10]. The low completion ratio indicates the dire state of the university system in the region[11]. Completion

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8 Calculated from Eurostat online data, variable code [educ_uoe_grad02].

9 The main changes over the four years in question were a fall in the proportion of students completing studies in Business, administration and law, which fell from 26.4% to 22.8% of graduates, and corresponding small upward shifts in the study fields of Health and welfare, and Services.

10 The total number of new entrants to tertiary studies in Serbia in 2017 was 79 880 (Eurostat online data), of whom 5.8% were enrolled in ICT programmes (Statistical Office of the Republic of Serbia – SORS), giving 4 633 entrants into this subject field. In the same year 2 612 students graduated from such courses (SORS online data).

11 The 'completion rate' (rather than the ratio) is another indicator of the effectiveness of a higher education system (European Commission/EACEA/Eurydice, 2015), and is calculated by the 'cross-section' method, whereby the ratio of the number of graduates completing studies in year 't' is divided by the number of students who enrolled in year 't-x', where 'x' is the duration of the study programme. This method of calculating

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7 The face-to-face interviews were carried out by local experts in each country.

Table 13.1. New enrolments and completions by field of study, 2013/14 (%)

Field of study	ENROLMENTS							COMPLETIONS						
	AL	BA	XK	MK	ME	RS	WB	AL	BA	XK	MK	ME	RS	WB
01 Education	9.1	9.1	6.2	2.7	2.6	8.3	7.5	9.7	12.7	3.6	6.2	4.0	10.1	9.0
02 Arts & humanities	11.4	11.2	9.3	13.3	10.4	7.2	10.0	11.9	8.8	12.3	11.6	12.3	9.3	10.5
03 Social sciences, journalism & information	9.8	18.7	13.0	9.8	19.5	10.8	12.5	9.3	28.3	11.4	12.9	23.4	9.1	11.8
04 Business, administration & law	28.8	11.7	42.9	26.1	24.5	22.4	26.1	28.2	11.0	47.0	28.8	27.3	26.4	28.0
05 Natural sciences, mathematics & statistics	5.7	5.1	3.1	3.5	2.8	4.3	4.4	6.3	3.5	6.0	3.0	2.2	4.7	4.9
06 Information & communication technologies	5.9	3.6	5.9	9.7	6.7	7.5	6.3	5.5	3.5	2.9	7.2	6.2	5.5	5.2
07 Engineering, manufacturing & construction	8.1	18.9	8.4	13.3	16.3	18.6	13.7	7.3	11.4	4.3	9.8	11.3	17.6	12.2
08 Agriculture, forestry, fisheries & veterinary	3.4	5.1	1.9	2.3	2.6	4.2	3.5	3.5	2.9	1.0	2.3	2.6	2.4	2.6
09 Health & welfare	13.5	13.4	5.5	11.6	2.7	8.4	10.1	14.0	16.4	6.7	8.9	3.7	8.0	10.0
10 Services	4.3	3.0	3.7	7.7	11.9	8.3	5.7	4.3	1.4	4.7	9.2	7.0	6.8	5.7
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100
HSS (ISCED 02+03+04)	50.0	41.7	65.3	49.1	54.4	40.4	48.7	49.4	48.1	70.8	53.3	63.0	44.8	50.4
STEM (ISCED 05+06+07)	19.7	27.7	17.4	26.5	25.7	30.4	24.4	19.2	18.4	13.2	20.1	19.7	27.8	22.4

Note: HSS – Humanities, social science and business; STEM – Science, technology, engineering and mathematics; AL – Albania; BA – Bosnia and Herzegovina; XK – Kosovo; MK – North Macedonia; ME –Montenegro; RS – Serbia; WB – Western Balkans.

Source: National statistical offices.

Table 13.2. Regression model for satisfaction with quality of tertiary education

	COEFFICIENT	t-STATISTIC
Whether internship was used	0.92***	14.02
Classes in small groups much used	0.75***	11.69
Above average performance	0.83***	12.89
Whether attended gymnasium	-0.27***	-4.09
06 Information & communication technologies	-0.63***	-5.18
07 Engineering, manufacturing & construction	-0.17*	-1.72
Master's degree	0.17***	2.66
Doctoral degree	0.90***	2.99
Public higher education institution	-0.97***	-12.24
Albania	-0.62***	-7.32
Constant	6.64***	61.27
N = 3 707; Adjusted R-squared = 0.238; F-statistic = 105.7***		

Notes: The regression model was processed with SPSS by the method of backward elimination to give the best fit to the data. All independent variables are 0–1 dummies. Country dummies other than Albania are not significantly different from the base level (Serbia) and are not shown. Field of study dummies other than 06 and 07 are not significantly different to the base level (04 Business, administration and law) and are not shown. The base level for degree level is Bachelor's degree. The constant shows the base level of satisfaction with quality of education when all dummies are set to zero. Significance levels are represented as: * = 10%; ** = 5%; *** = 1%.

Source: Graduate survey of 2014/15.

of studies is an important element of a successful university system. A low completion ratio however suggests that significant numbers of students drop out of university before completing their studies or take an excessive amount of time to complete their education. This represents a waste of resources and also indicates dissatisfaction with the courses that are on offer.

The graduate survey reveals widespread dissatisfaction with university programmes, especially in the ICT study field. The survey asked respondents to evaluate their satisfaction with the quality of courses at the university where they last

completion rates is more robust than taking the ratio of completions and enrolments in a single year, as it tracks the performance of a given cohort through time. In the region as a whole, the average completion rate of 46% for Bachelor's programmes was found to be lower than that of Hungary, which at 48% was recorded as the lowest in the European Higher Education Area for which data were available (Eurydice, 2015). In comparison, the average completion rate in the OECD countries was 68% in 2013 (OECD, 2013).

studied on a 1–10 scale. Satisfaction with quality of tertiary provision in the Western Balkans as a whole scored an average of 7.1 on this scale, with a significantly lower rating for Albania than other countries of the region. Several factors determined graduates' satisfaction with the quality of their education, including the school they attended previously, their individual academic performance, whether classes were taught in small groups or not, the level of their degree, the study programme followed, the provision of work experience through internships, and the ownership status of the university. A linear regression model was estimated to identify how these factors determine variations in satisfaction with the quality of education (see Table 13.2).

The regression analysis reveals that several factors have a positive impact on satisfaction with the quality of university education. Worryingly, ICT graduates have a demonstrably lower level of satisfaction with the quality of their education than those who studied Business, administration and law – the baseline for the analysis. This

suggests that universities throughout the region are failing to provide education of sufficiently high quality in a key subject that will be crucial for the development of competitive digital economies in the future. The regression results also show that satisfaction with the quality of education received at university is positively related to whether a graduate had received work experience through an internship, and whether learning took place in small class groups rather than large lecture theatres. The personal characteristics of the graduate also affect satisfaction with studies, with those who demonstrated above average performance more likely to have a positive level of satisfaction with their studies. However, those who had attended a gymnasium (grammar) school (relative to those who attended vocational school) were less satisfied with the quality of their studies at university, perhaps indicating that universities do not provide sufficiently challenging environment for the more academically experienced students.

13.3 The graduate labour market and demand for digital skills

Throughout the Western Balkan region, there is concern that graduates face a difficult transition into the labour market. Having a university degree improves the chances of finding a job, yet the rate of graduate unemployment remains relatively high (see Table 13.3). However, with the exception of Albania, the unemployment rate of university graduates is everywhere lower than that of the total labour force. (The Albanian exception probably reflects the high outward migration of less skilled workers.)

University graduates also benefit from higher employment rates than the total labour force. In Kosovo, the employment rate for graduates is double that of the total population, and other countries also show a high graduate advantage in terms of employment. However, it should be noted that both total and graduate employment rates are below the EU average. The extent of graduate unemployment in the region risks incurring a depreciation of skills (so-called 'scarring' effects) that have been acquired at high economic cost within the higher education systems.

Graduates face many challenges when they leave university and start looking for work. On average, employed graduates take nine months to find their first job, they have held two different jobs since leaving university, and 57% have experienced at

Table 13.3. Unemployment and employment rates of higher education graduates and whole labour force, 2018 (%)

	UNEMPLOYMENT RATE		EMPLOYMENT RATE	
	TOTAL	ALL HIGHER EDUCATION GRADUATES	TOTAL	ALL HIGHER EDUCATION GRADUATES
Albania	11.3	12.6	67.7	72.9
Bosnia and Herzegovina[a]	15.8	12.0	49.7	70.5
Kosovo[b]	25.7	21.5	30.1	62.2
Montenegro	15.2	11.6	60.8	77.8
North Macedonia	17.2	14.3	59.2	77.5
Serbia	10.6	8.5	65.2	79.8
Western Balkans – average	16.0	13.4	55.5	73.5
EU-28	6.2	4.0	73.9	85.0

Notes: Data are for the 20–64 age group with two exceptions: [a] data for higher education graduates aged 15–64; [b] data for all Kosovo indicators apply to those aged 15–64.

Source: Labour force surveys from national statistical offices and Eurostat online data.

least one period of unemployment since entering the labour market over a period up to three years prior to the graduate survey. The transition from university to the labour market is therefore far from being a smooth process for many graduates. Graduates face a lack of adequate information about career opportunities, and so social networks step in to fill the gap. This leads to an uneven playing field, with the most well-connected graduates able to access the best jobs. Throughout the Western Balkans, the family is the main source of assistance in finding a job, closely followed by friends.

In the graduate survey, respondents rated the help they received in finding a job from various sources on a 1–5 Likert scale, ranging from 1 – 'not helpful' to 5 – 'very helpful'. Job search assistance from family members scored 3.2 on this scale and help from friends was rated at 2.6. In contrast, assistance from the public employment services scored 1.4 and university career guidance centres achieved a rating of just 1.3. This highlights the importance of personal connections in the job-seeking process. In contrast, assistance from formal public employment services or from university careers services appears relatively trivial. This suggests that the public employment services' support for university graduates should be strengthened, although it may be unrealistic to expect these underfunded services to make a

large impact on ICT graduates' chances of finding work (Scharle, 2018). University careers services should therefore be encouraged to devote more resources to advancing the job-seeking prospects of their graduates as they are likely to have better and more informed relations with relevant employers.

According to the employer survey, the information and communication business sector achieved the highest growth in terms of graduate employment over the period 2012–15 (see Figure 13.1). However, this trend shows certain differences across the countries of the region. While Information and communication was the most rapidly expanding sector in North Macedonia and Serbia, in Albania and in Bosnia and Herzegovina the fastest growing sector was Manufacturing, in Kosovo it was Professional, scientific and technical activities and in Montenegro it was Accommodation and services. These patterns reflect the sectors in which individual countries have a comparative advantage, for example, Serbia in ICT services and Montenegro in tourism.

The rapid growth of graduate jobs in the Information and communication sector is a clear indication that graduates from related fields of study are likely to be in high demand. It is also worth noting that this sector has a greater share of 'gazelle'-type

Figure 13.1. Annual % change in graduate employment in major sectors of activity – Western Balkans, 2012–15
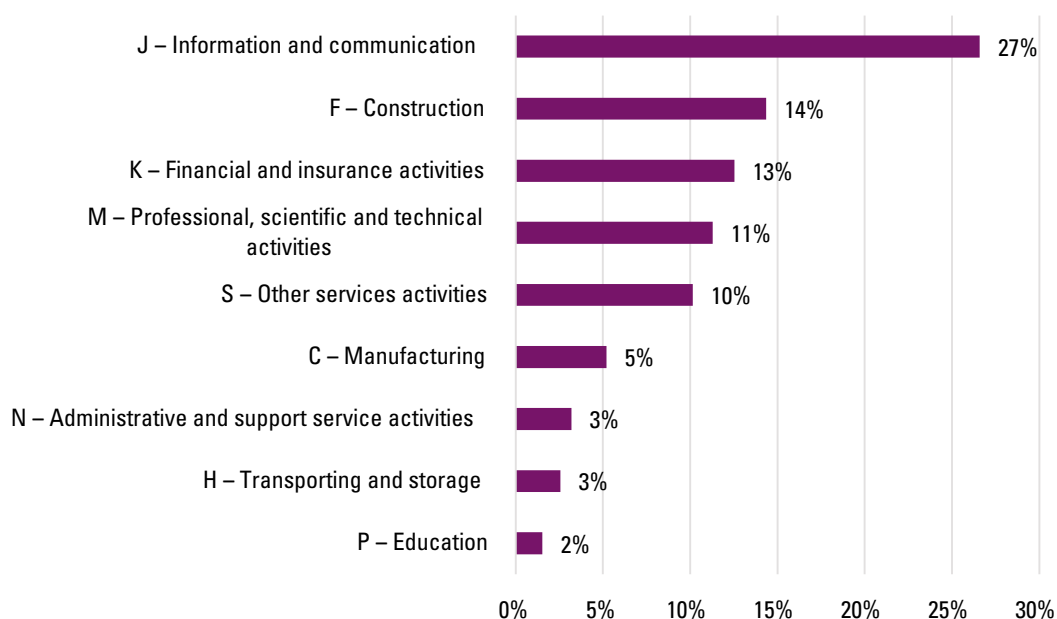
Note: The sectors shown account for over 80% of graduate employment.

Source: Employer survey.

employers (27%) than any other[12]. Employers in this sector have experienced a rapid and sustained growth in jobs over a period of years and are likely to be the fast-growth enterprises of the future. The demand for graduates with ICT degrees, along with other STEM qualifications, is likely to expand more rapidly than for other degree types since high technology businesses tend to grow much faster than other types of enterprise. From the employer survey it was found that the rate of growth of graduate employment was 7.7% per annum among high technology businesses, compared to just 3.3% for medium and low technology firms. As shown in the next section, there is a widespread and increasing shortage of graduates from the ICT study fields. In the future, universities will need to respond to this shortage in order to meet the growing demand from employers and to ensure that bottlenecks in the supply of skills do not hold back economic growth.

13.4 Forecasts of future demand for higher education graduates in Serbia

How will this increased demand for graduates in the fast-growth sectors of the Western Balkan economies translate into demand for university graduates with digital skills? To answer this question, I have developed a forecast of the likely demand for university graduates by field of study in the period up to 2021, following the procedure used in Bartlett et al. (2016). The analysis is carried out on the demand side, projecting forward the annual change in demand for graduate labour on the basis of information on graduate employment by sector of economic activity taken from national labour force surveys. Following the methodology of Cedefop (2010), I identify both 'expansion demand' and 'replacement demand'. Expansion demand is the extra demand resulting from economic growth, while replacement demand arises from retirement and migration.

The forecast is carried out for the case of Serbia, for which up-to-date data is more readily available than other Western Balkan countries. Moreover, Serbia has a leading position in the region regarding the use of digital skills in the workplace, due to its increasingly important digital economy sector. For example, 5% of small enterprises in Serbia make use of 3D printing compared to only 3% in the EU[13].

Total graduate employment in Serbia increased from 574 000 in 2014 to around 765 000 by 2019, an increase of over 191 000 in total, or around 38 000 a year. This growth is the 'expansion demand' due to the net increase in job openings for graduates. To this I add the 'replacement demand' that results from the retirement of currently employed graduates and other demographic reasons for people leaving the labour force. Replacement demand for university graduates was estimated to average about 17 000 per annum over the period 2015–19[14]. The overall annual increase in demand for graduates is the sum of the expansion and the replacement demand. Taking these two sources of demand for graduates into account, the total annual increase in demand for graduates was about 49 000 per annum between 2015 and 2019.

To obtain a forecast for the number of graduates that will be required from the university system in the following two years, I apply the expected future rate of growth of the economy to these data broken down by sector of business activity[15]. On this basis, total demand for university graduates is expected to decrease slightly, from 57 737 in 2019 to 56 105 in 2021 (see Table 13.4). The demand for graduates is expected to fall in 2020 due to the effects of the Covid-19-related health crisis in reducing economic growth. According to the IMF (2020), Serbia is expected to experience a 3% fall in GDP in 2020 (similar to other countries in the region). Since the growth in demand for university graduates typically exceeds GDP growth by about this amount, I forecast a 0% growth in demand for university graduates in 2020. This is then expected to bounce back to a 5% growth in 2021, yielding the forecast set out in Table 13.4.

Change in the demand for graduates at sector level has implications for the pattern of recruitment that the university system should anticipate. In order to address this issue, we use data from the graduate survey to estimate a transformation matrix that connects the sector in which graduates are employed to their field of study. This converts the forecasts of the sectoral demand for graduates into one showing the demand for graduates by field of study. This is then contrasted with the supply of graduates by subject area derived from the

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[12] A gazelle is a company that has expanded its employment by at least 20% per annum over the previous three years (Eurostat definition).
[13] Eurostat online data variable code [isoc_eb_p3d].

[14] On the basis of a 2.5% retirement rate and a 0% net migration rate (Eurostat data).
[15] Here I am forecasting forward from the 2019 level two years ahead. This is not a long period, but the further one forecasts the higher the measurement errors are likely to be. The methodology can easily be adapted to a longer time horizon. The sectoral distribution follows the NACE Rev. 2 classification.

Table 13.4. Expansion, replacement and total demand for graduates by economic sector – Serbia, 2019 and 2021

SECTOR	EXPANSION		REPLACEMENT		TOTAL DEMAND	
	2019	2021	2019	2021	2019	2021
A	1 229	1 147	573	602	1 802	1 749
B	289	270	135	142	424	412
C	3 994	3 726	1 863	1 956	5 857	5 682
D	638	595	297	312	935	907
E	526	491	245	258	771	749
F	1 372	1 280	640	672	2 012	1 952
G	4 405	4 110	2 055	2 158	6 460	6 268
H	1 453	1 355	678	712	2 131	2 067
I	417	389	195	204	612	593
J	1 805	1 684	842	884	2 647	2 568
K	1 562	1 457	728	765	2 290	2 222
L	27	25	13	13	40	38
M	2 978	2 778	1 389	1 459	4 367	4 237
N	700	653	326	343	1 026	996
O	4 413	4 117	2 059	2 162	6 472	6 279
P	7 953	7 419	3 710	3 895	11 663	11 314
Q	3 865	3 606	1 803	1 893	5 668	5 499
R	1 018	950	475	499	1 493	1 449
S	727	679	339	356	1 066	1 035
Total	**39 372**	**36 731**	**19 125**	**20 081**	**57 737**	**56 015**

Note: A – Agriculture, forestry & fisheries; B – Mining & quarrying; C – Manufacturing; D – Electricity, gas, steam & air conditioning supply; E – Water supply; F – Construction; G – Wholesale & retail trade; H – Transportation & storage; I – Accommodation & food service activities; J – Information & communication; K – Financial & insurance activities; L – Real estate; M – Professional, scientific & technical activities; N – Administrative & support service activities; O – Public administration & defence; P – Education; Q – Health & social work activities; R – Arts, Entertainment & recreation; S – Other services.

Source: Own calculations based on Serbian labour force survey data 2014–19.

Statistical Office of the Republic of Serbia to provide estimates of the excess demand for graduates in each field of study (see Table 13.5)[16].

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[16]   The annual surveys on enrolled students and graduates cover all students enrolled at all cycles of studies in the school year.

The annual requirements for graduates are in excess of the actual output of the university system, even under the current negative impact of a Covid-19 economic contraction in 2020, so that each year the total number of graduates falls short of the number of jobs available. This differs from the situation in the mid-2010s when there was a surplus of graduates (Bartlett et al., 2016). The relatively rapid growth of

Table 13.5. Annual new demand and supply of graduates by field of study – Serbia, 2019 and 2021

FIELD OF STUDY	DEMAND		SUPPLY 2018	EXCESS DEMAND (%) 2019	EXCESS DEMAND (%) 2021
	2019	2021			
01 Education	4 490	4 290	3 664	17.1	14.6
02 Arts & humanities	4 367	4 030	4 290	-3.3	-6.4
03 Social sciences, journalism & information	9 978	9 283	4 665	51.2	49.7
04 Business, administration & law	16 355	14 371	10 473	29.3	27.1
05 Natural sciences, mathematics & statistics	6 189	5 365	2 361	57.3	56.0
06 Information & communication technologies	3 970	3 767	2 567	33.9	31.8
07 Engineering, manufacturing & construction	5 934	6 325	7 843	-20.3	-24.0
08 Agriculture, forestry, fisheries & veterinary	1 032	1 346	1 114	19.7	17.3
09 Health & welfare	4 122	5 086	4 416	15.8	13.2
10 Services	2 443	2 151	4 013	-81.0	-86.6
Total	58 880	56 014	45 406	21.4	18.9

Note: Excess demand = [demand (t) - supply (2018)] / [demand (t)] (the forecast assumes a stable annual supply).

Source: Own calculations based on data from Serbia Labour Force Survey (for demand) and SORS 'Tertiary education 2017/2018' (for supply of graduates by field of study).
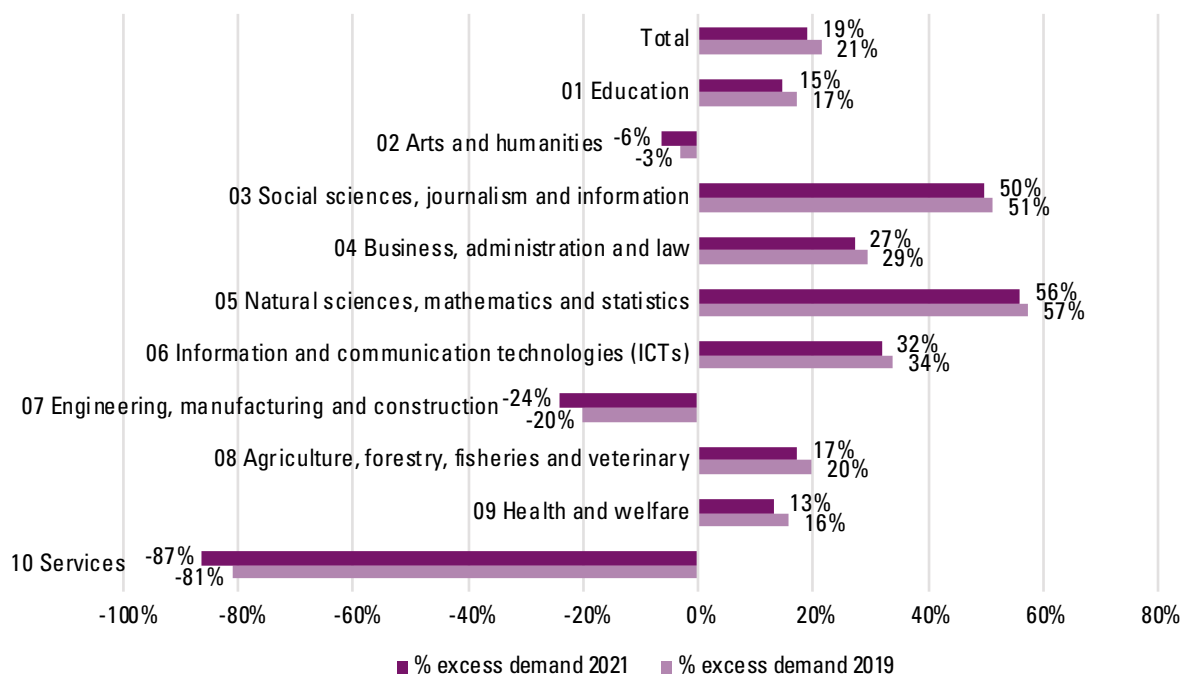
the economy over the last five years turned this situation around, so that by 2019 there was an overall *shortage* of graduates. Assuming a scenario of zero growth in demand in 2020, followed by a bounce back in annual growth in 2021, the total demand for graduates in 2021 is expected to be slightly below that of 2019.

In detail, Table 13.5 shows the projected demand for graduates by field of study from 2019 to 2021 against the actual supply of graduates in 2018, which is used as a benchmark. In 2021 there is expected to be an overall shortage of over 10 600 new university graduates, equivalent to 18.9% of the overall demand for degree-level entrants (down from 12 300 in 2019, due to the coronavirus crisis). The excess demand will likely be filled from the pool of unemployed graduates (the rate of which was still over 10% in 2018 – see Table 13.3).

By field of study, there is a severe shortage of graduates in ICT subjects, alongside equally severe shortages in the supply of graduates from Social sciences, journalism and information, Natural sciences, mathematics and statistics, and Business administration and law (see Figure 13.2). In contrast, large surpluses of graduates continue to be seen in the study fields related to Services[17], and to some extent in Engineering, manufacturing and construction. The shortages of graduates in the fields related to Information and communication technologies is worrying given the importance of these skills to the emerging digital economy. This trend towards a shortage of graduates is likely to persist in the future given the current supply

[17] The Services group of study fields includes subjects such as transport, travel, tourism, occupational health, and security (including military and defence).

Figure 13.2. Shortages of tertiary-level graduates by field of study – Serbia, 2019 and 2021 (%)

Total: 19%, 21%
01 Education: 15%, 17%
02 Arts and humanities: -6%, -3%
03 Social sciences, journalism and information: 50%, 51%
04 Business, administration and law: 27%, 29%
05 Natural sciences, mathematics and statistics: 56%, 57%
06 Information and communication technologies (ICTs): 32%, 34%
07 Engineering, manufacturing and construction: -24%, -20%
08 Agriculture, forestry, fisheries and veterinary: 17%, 20%
09 Health and welfare: 13%, 16%
10 Services: -87%, -81%

■ % excess demand 2021   ■ % excess demand 2019

Note: Shortage of graduates = % excess demand = Excess demand (t) / Demand (t).

Source: Own calculations based on data from Serbia Labour Force Survey (for demand) and SORS 'Tertiary education 2017/2018' (for supply of graduates by field of study).

of graduates from the higher education sector. It reflects the expected future medium-term increase in the number of ICT jobs resulting from economic growth, even though this is currently disrupted by the coronavirus crisis.

The results of this study can be compared to those of other countries of the Western Balkans. This can be done by applying a linear projection of trends identified in the study by Bartlett et al. (2016). It should be noted that this is not a modelling approach, as set out above, and so the results should be treated with caution; a true comparison would require the same methodology to be applied to all countries, which is beyond the scope of this article. The resulting projection suggests that the Serbian experience is likely to be reproduced throughout the Western Balkans as previous surpluses of graduates give way to shortages in most countries, in some cases quite rapidly. The forward projections of the excess demand for graduates in ICT subjects suggest that by 2021 there will be a shortage equivalent to 40.0% of the demand for graduates in this study field in Albania, and shortages of 40.5% in Bosnia and Herzegovina, 37.2% in Kosovo and 26.5% in Montenegro. The only exception is North Macedonia where the projections suggest that the previous surplus of graduates is likely to persist, with only

a slight shortage of 1.2% emerging in 2021. This result may reflect the relatively low demand for ICT specialists; for example, only 1.9% of employees in North Macedonia were ICT specialists in 2019, compared to 2.6% in Serbia[18]. It may also indicate the historically high unemployment rate in North Macedonia, generating a pool of available graduates with digital skills on which employers can draw[19].

13.5 Skill mismatch

Digital transformation is likely to become an increasingly powerful force that displaces workers from their jobs, with artificial intelligence replacing many roles carried out today by even highly skilled workers. Alongside the destruction of jobs, new roles will be created that are complementary to the new technologies. However, the existing skills of workers are likely to be poorly matched to the requirements of the newly created jobs. These positions are likely to require substantial reskilling

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[18] See Eurostat online data: employed ICT specialists – total [isoc_sks_itspt].

[19] The unemployment rate among university graduates in North Macedonia reached a peak of 23.5% in 2013 and has fallen only gradually since then to 14.3% in 2019 (Eurostat: une_educ_a).

Figure 13.3. Vertical matching by broad field of study – Western Balkans (% of graduates)
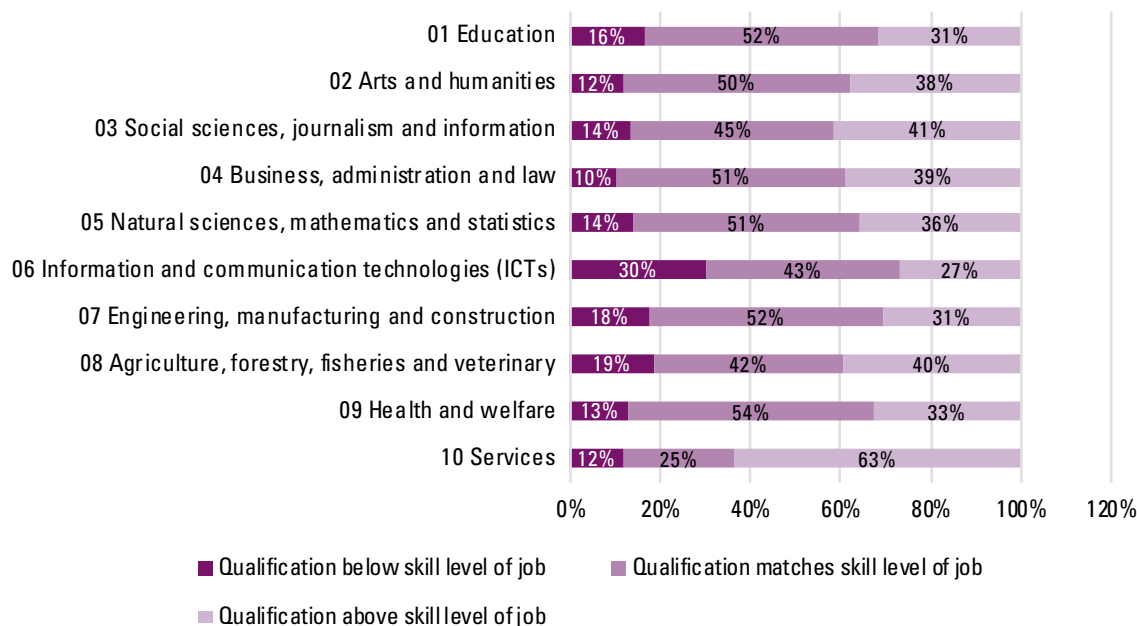
Source: Graduate survey data. Graduates were asked whether the skill level of their job matches their level of qualification.

and may be out of reach for many workers who are unable to adapt to these changes (Susskind, 2020).

The graduate survey provides data on the extent of the level of vertical skill mismatch among graduates in the Western Balkans[20]. Among graduates from ICT study fields, 27% have a level of qualification above that required by their job (see Figure 13.3), a lower proportion than for any other subject grouping; these graduates are 'over-qualified' as their qualifications are not being fully utilised. An equally serious problem is that of under-qualification. The survey findings reveal that, for almost all study programmes, a relatively small proportion of graduates, typically less than 15%, are under-qualified for the jobs they hold. The exception is graduates from ICT study fields, of whom as many as 30% are under-qualified. This suggests that the universities are failing to provide an adequate supply of graduates with the digital skills required by the rapidly changing labour market. It is worth noting that as few as 43% of graduates from the ICT study fields hold qualifications that are well matched to the jobs they hold, and that only two other fields of study (08 Agriculture, and 12 Services) have a lower proportion of well-matched graduates. Countries

differ in the degree of mismatch observed among recent ICT graduates. Montenegro and Serbia, for instance, have the highest proportion of ICT graduates who are well matched to their current job (65.2% and 51.8% respectively). Elsewhere, only between one third and one half of ICT graduates have well-matched jobs; the lowest percentage is found in North Macedonia (33.3%), while the proportions of well-matched ICT graduates are 35.3% in Bosnia and Herzegovina, 38.9% in Albania and 44.4% in Kosovo.

Various factors have a significant influence over whether university graduates find a well-matched job. Not surprisingly, graduates who performed better at university have a significantly higher chance of finding a well-matched job than others[21]. Teaching methods also have a significant influence on whether a graduate ends up in a well-matched job. Attending classes that are conducted in small groups and which use problem solving and creative thinking teaching methods predispose graduates to finding a well-matched job: 51% of those who stated that small groups were 'very much' a feature of their classes had a well-matched job, while only 39% of those who did not experience this

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[20] In addition, the employer survey provides a measure of skill gaps perceived by employers in 11 skill dimensions, including computer skills, which revealed a 12% skill gap in this field (reflecting the distance between employers' expressed needs and the skills of the graduates they employ) with a trend of increase over time.

[21] The graduate survey shows that 52% of graduates who assessed their own performance as 'far above average' have a well-matched job, compared to 43% of graduates who judged their performance as 'far below average' (Chi-Square = 27.8; p = 0.001; N = 2 283).

teaching method could make this claim[22]. Similarly, while 53% of graduates who reported that they had received 'very much' instruction in problem solving and creative thinking had a well-matched job, only 34% of those who had 'no' experience of this method of teaching were well suited to their current role[23]. A similar finding relates to the use of internships or work placements. While 52% of graduates who reported that internships or work placements were used within their study programmes had a well-matched job, only 40% of those who reported that these methods were not used had achieved this goal[24]. Thus, class size, appropriate teaching methods in interactive skills, and work experience while at university are of key importance in ensuring a graduate's ability to find a well-matched job.

The assistance provided by universities to graduates in their job search activity also has a positive effect on the probability that a graduate will find a well-matched job. While 63% of those whose university provides 'very much' job search assistance found a well-matched job, only 41% of those who did not receive assistance were similarly well placed[25]. This mainly reflects the importance of the personal support given by university professors to individual graduates rather than the effectiveness of university career centres. The graduate survey also revealed the importance of assistance from public employment services. While 68% of graduates who received 'very much' support from public employment services were employed in a suitable position, among those who received no support from public employment services only 47% were in a well-matched job. Since graduates receive relatively little support from public employment services overall, its strong positive impact on the success of graduates in finding a well-matched job suggests that these services should be encouraged and supported to further assist university graduates in their search for jobs.

13.6 Main findings and conclusions

Throughout the Western Balkans the growth in student numbers over the last decade has taken place with little regard for labour market needs. This is especially problematic since the pace of

growth in tertiary-level education has slowed down in recent years. The research reported above, based on a detailed modelling approach for Serbia and projections for other countries, reveals that there is an imbalance in the mix of graduates by field of study throughout the Western Balkans, with a general shortage of graduates with ICT qualifications. The Serbian forecasts further demonstrate that this situation is accompanied by an oversupply of graduates in other study fields such as *Arts and humanities* and *Services*. The projected shortages of ICT graduates are highest in Albania, Bosnia and Herzegovina, and Kosovo and lowest in North Macedonia. This likely reflects the scant provision of university courses in these study fields in the former, and the low demand for workers with ICT skills in the latter combined with a relatively large pool of unemployed ICT graduates. Without a change in national policies for the provision of tertiary education, the forecasted skill gap is likely to persist in the future.

In addition, the quality of tertiary education in ICT study fields is relatively poor, as confirmed by the significantly low levels of satisfaction with quality revealed in the graduate survey. Furthermore, university graduates experience a difficult transition into the labour market, with insufficient support and guidance provided for carrying out job searches. And finally, alongside the shortage of graduates in ICT study fields there is also a problem of severe skill mismatch for those with these qualifications who do manage to find a job. The proportion of ICT graduates with a well-matched job, relative to their level of qualifications, is among the lowest of any field of study. At the same time, the proportion of those with qualifications below the level required by the job is the highest of any field of study, indicating that the tertiary education system is failing to produce graduates in sufficient numbers or with an appropriate level of skills for the needs of the labour market. Montenegro and Serbia suffer least from this problem, with the highest proportion of well-matched graduates, while North Macedonia has the lowest share of ICT graduates in suitable jobs.

Thus, policies need to be designed to remedy the key problems relating to higher education in the ICT study fields, namely: (i) the lack of provision of the required volume of courses and study places in ICT at universities; (ii) the poor quality of that provision, including the lack of up-to-date content and technology used for learning purposes; (iii) the inadequate assistance provided for job seeking on graduation; and (iv) the consequent problem of graduate mismatch in the labour market.

A number of policy changes should therefore be introduced to deal with these issues. First, the

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[22] Pearson Chi-squared = 32.2; significance level = 0.000; N = 2 277.

[23] Pearson Chi-squared = 68.8; significance level = 0.000; N = 2 288.

[24] Pearson Chi-squared = 32.2; significance level = 0.000; N = 2 277.

[25] Pearson Chi-squared = 72.0; significance level =0.000; N = 2 261.

volume of study places in ICT study programmes needs to be expanded. Governments should use scholarships to steer students towards these priority subjects and away from over-supplied areas such as Arts and humanities, and Services. Universities should provide more information to potential applicants on the likely labour market demand for various study programmes. This could be done through outreach programmes to local schools in partnership with public educational guidance services. Universities could also be encouraged to support schools to raise the quality of their instruction in digital studies. Educational guidance should be given to secondary school students before they enrol in university courses to ensure they have better information about the likely labour market prospects of a particular study programme. More cooperation with employers is also needed to develop new ICT study programmes. At the same time, institutional arrangements such as sector skills councils should be supported to bring employers and universities together with local government bodies to identify skills needs and take joint actions.

Second, the quality of tertiary education provision should be improved. Universities should modernise their curricula and improve their teaching methods in ICT study fields, as well as in other subjects, to promote a more student-centred approach to learning, incorporating the use of small discussion-based classes, student presentations, teamwork assignments, and analytical and practical problem-solving exercises. Applied knowledge and critical thinking skills should be the core focus of teaching, rather than memorising material from textbooks. The quality and relevance of teaching in ICT is very much dependent on the technology, so it is crucial to have up-to-date equipment and access to the latest programming tools and software. Partnerships with software developers and specialised companies could be a useful step forward in this respect as universities cannot always fully keep pace with technological innovation.

Third, work experience gained through internship schemes can be instrumental in improving students' future job prospects. More focus on practical training is needed, including a period of internship in consultation with local employers. Universities should be encouraged to negotiate more work experience placements with local businesses so that graduates can enter the labour market with some prior work experience. Moreover, universities should integrate such practical work experience placements into their study programmes.

Fourth, students in ICT study fields should be provided with more information about the steps they can take before and after their transition to the labour market. Both universities and public employment services should provide improved support to graduates looking for work in order to enhance the allocative efficiency of the tertiary-level labour market and ensure that more graduates find well-matched jobs (aligned with their level of degree and field of study). Employers should also be encouraged to expand training programmes for graduate recruits in order to overcome the problems of skill mismatch, which primarily relate to under-qualification for the needs of the job. Active labour market policies (e.g. government support for lifelong training programmes) should be more specifically focused on recent ICT graduates. Graduates from ICT study courses should be encouraged to continue their training while at work through distance learning or day release for short professional courses. Several tools can be used to encourage this, for example tax breaks to compensate for the costs of employer-sponsored training, training subsidies or vouchers. Training support should also be given to small high-tech firms that employ graduates and have supply linkages to foreign investors, while governments should fund graduate training schemes for knowledge-intensive small and medium-sized enterprises that lack the resources to fund such programmes themselves.

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