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Employment and Skills Aspects of the Digital Single Market Strategy

Study for the EMPL Committee

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Employment and Skills Aspects of the Digital Single Market Strategy

DIRECTORATE GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT A: ECONOMIC AND SCIENTIFIC POLICY

Employment and Skills Aspects of the Digital Single Market Strategy

STUDY

Abstract

The ongoing and anticipated impact of digitalisation and the digital single market not only provides opportunities, but also presents challenges in terms of the job dynamics and changes in working conditions. The net effects of digitalisation on employment are ambiguous, but job losses in certain sectors are inevitable. Classic employer-employee relationships are also under pressure. The transformation of jobs calls for different skills requirements which could lead to growing skill gaps and mismatch in the labour market.

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LIST OF ABBREVIATIONS

AMT	Amazon Mechanical Turk
B2C	Business to consumers
Cedefop	European Centre for the Development of Vocational Training
DESI	Digital Economy and Society Index
DSM	Digital Single Market
e-CF	European e-Competence Framework
EESC	European Economic and Social Committee
ETUC	European Trade Union Confederation
EU	European Union
Eurofound	European Foundation for the Improvement of Living and Working Conditions
EWCS	European Working Conditions Surveys
ICT	Information and Communication Technologies
IFTF	the Institute for the Future
ILO	International Labour Office
iOS	Iphone Operating System

iPro	independent professional
MOOCs	Massive Open Online Courses
MSPs	multi-stakeholder partnerships
OECD	Organisation for Economic Co-operation and Development
OER	Open Educational Resources
PIAAC	Programme for the International Assessment of Adult Competencies
SBA	Small Business Act for Europe
STEM	Science, Technology, Engineering, Mathematics
USD	United states dollars
VET	vocational education and training

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EXECUTIVE SUMMARY

The digital divide between Member States

Digitalisation has a substantial impact on the labour market, by modifying job dynamics, working conditions and skills needed. The transformations induced by digitalisation constitute both opportunities and risks. However, each Member State will not be affected in the same way, as development and integration of digitalisation across the European Union is uneven. The highest performing countries (Scandinavian countries and the Netherlands) are considered world leaders in digital competitiveness. Conversely, some new EU Member States and South European Countries are lagging behind. This **digital divide** should be taken into account when analysing the impact of digitalisation on the European labour market.

Competing effects on job dynamics

Digitalisation has the possibility to create jobs by generating **new business models, new products** (e.g. the app technology), **new machines** (3-D printing) and reducing the **cost of production**. The gains vary per sector, depending on the interaction of the production costs, organisation and potential market reach of each sector.

But digitalisation also has the potential to destroy jobs or tasks. Estimates indicate that 40 to 60% of the jobs in EU Member States are at risk from automation, with medium-skilled jobs considered most at risk. It also facilitates the **outsourcing of jobs** or parts of jobs to countries with low labour costs.

While it is clear that some sectors will gain and others will lose, the net impact remains ambiguous. According to Cedefop's (2010) latest forecast of the skills demand and supply in Europe, the **net impact will be positive**: around seven million extra jobs by 2020, with digitalisation one of the key factors.

Major transformations in the organisation of work

Digitalisation induces major transformations in the organisation of work and employment relationships. This encourages evolutions at a micro-economic level (companies and individuals) but also at a macro-economic level (the labour market and society).

At a micro-economic level, workers have the flexibility to work anytime and anyplace. This has positive consequences for the employment of people seeking more flexible work arrangements (women, older workers) but also less mobile people, through **new ways of working flexibly and new types of employment relationships**, such as telecommuting or telework, freelance work or independent professional (iPro), crowdsourcing and employment in the shared economy.

Anytime and anyplace working offers opportunities to develop worker-friendly forms of flexibility but also has some **negative side effects**: Work intensification and the obligation to be always available may cause stress and burn-out, while access to social protections for workers under these flexible arrangements is often unclear.

At a macro-economic level, digitalisation is leading to the **gradual polarisation** of employment in terms of work autonomy and wages, inducing increased inequalities: Jobs are more likely to be situated at either the high or the low end of the wage and autonomy distribution, with a declining number in-between.

All the evolutions in working conditions also create major challenges for the **social security models** of EU countries. In most EU countries, these were developed in a period when male, full-time and fixed-term contracts were the dominant feature. Due to digitalisation, new flexible employment relationships are emerging, resulting in atypical career patterns. Policymakers will therefore face a significant challenge to bring their social protection mechanisms into line with the new flexible employment relationships and ensure social protection for all types of workers.

Shift in skills needs

Workers will increasingly need to have both generic and specialised e-skills to accomplish their tasks at work and capture potential productivity gains. However, a **significant part of the population lacks the basic skills** necessary to function in this new environment. Precisely the people with the lowest levels of ICT skills and who are least prepared to update their skills will be hit the hardest by labour market disruptions.

Moreover, the **job matching and recruitment process** increasingly makes use of digital methods. This evolution may also constitute an important barrier for older job seekers and low-skilled unemployed people with limited e-skills.

The new skills needed require **reforms in initial vocational education and lifelong learning** in order to deliver more general and specific digital capabilities but also new models of learning. The rapidly changing nature of advanced ICT makes **workplace training**, in addition to formal education, increasingly important for adapting workers' skills. Encouraging **STEM studies** is also essential in order to fulfil the increasing bottleneck vacancies like ICT professionals, health professionals, and science and engineering professionals. Moreover, digital technology will also challenge traditional **methods of delivering education and training**. E-learning, web-based educational material, distance study, online universities and programmes are ways to offer flexible learning pathways to students and workers.

Policy recommendations

Several initiatives at European level support the evolution towards a digital economy and society, for instance by supporting digital entrepreneurship. Across the EU-28, albeit with substantial variation, there are also more than 100 national policies dealing broadly with developing e-skills and putting them to effective use.

Based on the mainfindings, the following policy recommendations could be stressed:

- Workers on **low to medium incomes** are most at risk when it comes to job losses caused by digitalisation. Therefore, shifts in demand for labour induced by digitalisation should be **monitored closely** and **measures to support and guide these workers** during such transitions should be offered. This will need further improvement of job guidance and training programmes in order to respond to the new needs of the labour market.

- To avoid the digital divide and increased inequality between EU Member States, **reforms in initial vocational education and lifelong learning** should be closely monitored and implemented in each Member State.

- There is a need for a **common definition of the different new types of work** (teleworking, freelance working, crowdsourcing…) in order to monitor these phenomena closely and their impact on the labour market statistics.

- The new forms of work confront companies and governments with **new questions regarding social protection, and health and safety issues**. The legal framework of these different types of work may need to be updated in specific areas in order to maintain worker protection and adequately cover new forms of work.

- To protect workers' private lives and prevent mental health issues, European framework legislation should establish the **right of employees** to clearly define working and leisure time and to switch off mobile communication devices outside of working time.

Future areas for research

- The **net effect of digitalisation** for the jobs in Europe is yet not known and would need further research.

- The possible **negative side effects** induced by the new ways of work should be further analysed.

- There is a need **to collect and monitor data** on the new types of jobs in order to identify the impact of these new forms of work on the labour market statistics.

Please find more detailed information in the summary boxes presenting key findings for each section.

1. INTRODUCTION

1.1. Context of the briefing note

The President of the European Commission, Jean-Claude Juncker, claimed in his opening statement in the European Parliament on July 15th of 2014 that '*by creating a connected digital single market, we can generate up to € 250 billion of additional growth in Europe in the course of the mandate of the next Commission, thereby creating hundreds of thousands of new jobs, notably for younger job seekers, and a vibrant knowledge-based society*'. This quote indicates the **enormous impact** the digital single market could have on the labour market and society in general. The OECD (2015) states in its 'Digital Economy Outlook' that *'the full potential of the digital economy has yet to be realised'*.

The ongoing and anticipated impact of digitalisation and the digital single market not only provides opportunities, but also presents challenges in terms of the **job dynamics.** Even if the net effects of digitalisation on employment are ambiguous, job losses in certain sectors are inevitable (OECD, 2014).

Digitalisation also causes major **changes in working conditions**. The classic employer-employee relationships are under pressure. This means that digitalisation requires a significant reorganisation of the labour market.

Finally, the transforming jobs require different **skill requirements**. The importance of ICT skills for every citizen is evidently growing, but digitalisation also creates a demand for specialised workers with strong interpersonal and cognitive skills (OECD, 2014). This evolution could lead to growing skills gaps and mismatch in the labour market. There is an important role here for education and vocational training.

1.2. Policy Context

Completing the Digital Single Market is the main goal of the **Digital Agenda**, which forms one of the seven pillars of the **Europe 2020** Strategy.

In its Communication on a Digital Market Strategy (DSM) for Europe (COM (2015), 192 final), the European Commission describes the **Digital Single Market** as '*one in which the free movement of goods, persons, services and capital is ensured and where citizens, individuals and businesses can seamlessly access and exercise online activities under conditions of fair competition, and a high level of consumer and personal data protection, irrespective of their nationality or place of residence'.*

The **strategy** set out by the European Commission to realise a DSM is built on following pillars (COM(2015) 192 final):

- *"Further improve **access** for consumers as well as businesses to digital goods and services across Europe. This includes unlocking the full potential of e-commerce, for example by tackling 'geo-blocking'*

- *Shaping the right **environment** for digital networks and services. Measures such as creating the right conditions for infrastructure investment are key here.*

- *Creating a European **Digital Economy and society** with growth potential. An inclusive digital society where citizens have the right skills to seize the opportunities of the Internet and boost their chances of getting a job is an important aspect".*

Under these three pillars, 16 initiatives have been set out to realise the completion of the Digital Single Market.

The European Commission issued these policy measures based on a strong belief in the opportunities provided by digitalisation in a single market. If citizens develop the necessary digital skills, it can enhance their access to information, culture, the government and the labour market. The European Commission (2015) estimates that completing the DSM could contribute €415 billion per year to the European economy.

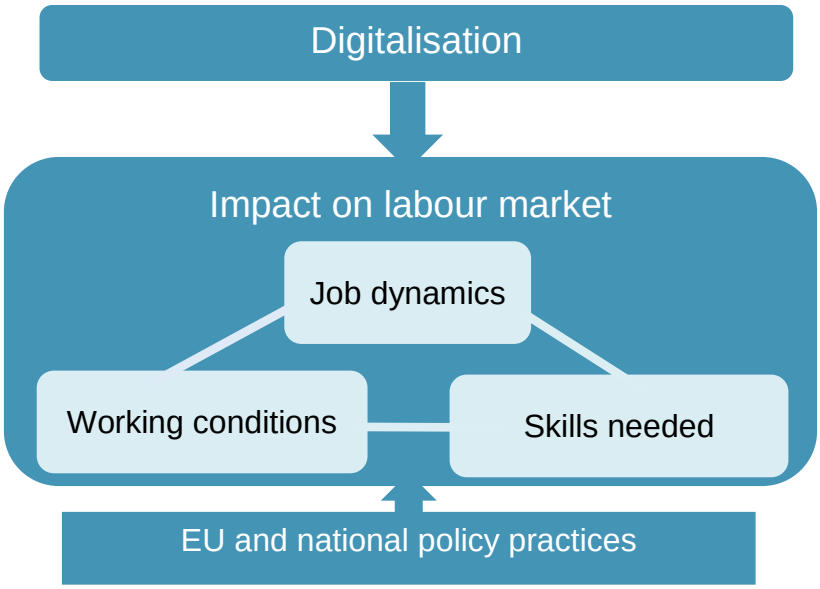
1.3. Objectives of the briefing note

The aim of this briefing note is to analyse the impact of digitalisation on:

- Job creation and job losses in different sectors;
- Changing working conditions:
  - Potential changes in the nature of employment relationships and employment forms;
  - Potential impacts on the health and safety of workers;
- Current and future skill requirements.

The figure below provides a visualisation of the analytical framework for this briefing note.

Figure 1: Analytical framework



Source: IDEA Consult

E-Commerce and related postal services are treated as 'sector cases' to guarantee a special focus on these topics.

Finally, the briefing note provides an overview of measures at national and European level promoting e-skills and jobs and digital entrepreneurship.

1.4. Methodology

For this briefing note we conducted an extensive literature and data review concerning the impact of digitalisation on the labour market, complemented by interviews with relevant stakeholders at the EU-level.

The starting point of the literature review was comparative European sources, such as publications produced by the European institutions, including Eurofound, the European Commission, the European Parliament and the European-level social partners representing trade unions and employment. Other relevant sources were also analysed, e.g. JRC and the OECD. This was complemented with academic literature. For an exhaustive list of the literature, we refer to the bibliography.

This briefing note has a qualitative focus, although it also involves the review of studies based on quantitative analyses. Some of the main data sources are Cedefop and PIAAC data of the OECD (Programme for the International Assessment of Adult Competencies).

After having collected and summarised all relevant literature, and in order to collect different visions of the impact of digitalisation on the labour market, we carried out interviews with following EU-level stakeholders:

- ETUC: Peter Scherrer (Deputy General Secretary), Wolfgang Kowalsky (Advisor).
- BusinessEurope: Guido Lobrano (Deputy Director), Robert Plummer (Advisor Social Affairs).
- Post Europe: Mr. Botond Szebeny (Secretary General), Mr. Wolfgang Pickavé (Vice President of Deutsche Post DHL Group) and Mr. Dominique Bailly (Director of 'Le Groupe La Poste' and Chair of the Corporate Social Responsibility Activities Circle).

1.5. Structure of the long briefing note

This briefing note is structured in the same way as our methodological document.

First, the **concept of digitalisation** is defined and the different dimensions it includes are discussed.

In chapter 3, the impact of digitalisation on **job dynamics** are presented.

Chapter 4 analyses the changing **working conditions** and organisation of work as a result of digitalisation.

In chapter 5, the divergent effects of digitalisation on **skills requirements** are distinguished.

In chapter 6, two interesting sectors are analysed in-depth: **e-Commerce and postal services.**

In chapter 7, the **main European and National measures** concerning e-skills, e-jobs and digital entrepreneurship are identified.

Finally, the main results are summarised in the last chapter. These results are used to formulate **recommendations** and identify the main needs for **further research**.

2. THE MAIN DIMENSIONS OF DIGITALISATION

Digitalisation is the driving force today, both in business and in private life (Vogelsang, 2010). After the steam, steel, electricity and petrochemical revolutions, this new 'General Purpose Technology' changes not only what we produce, but also how we produce it and how we organise it as a society.

The following quote illustrates clearly that digitalisation is more than just an ICT phenomenon, but a technological trend that has an impact on society as a whole. '*Digitalisation has been changing not just our economy but also our daily lives for at least the last twenty years, and it is expected that this process will continue. Where digital technology was once a niche market for specialists, it has become a general purpose technology which affects all sectors of the economy and society'* (European Commission, 2015).

However, it is important to note that, in this briefing note, we do not only focus on the impact of digitalisation on the labour market, as it is difficult to distinguish this evolution from other ICT evolutions, like automation. Especially concerning job creation and job losses, the impact of the most recent ICT evolutions are analysed globally.

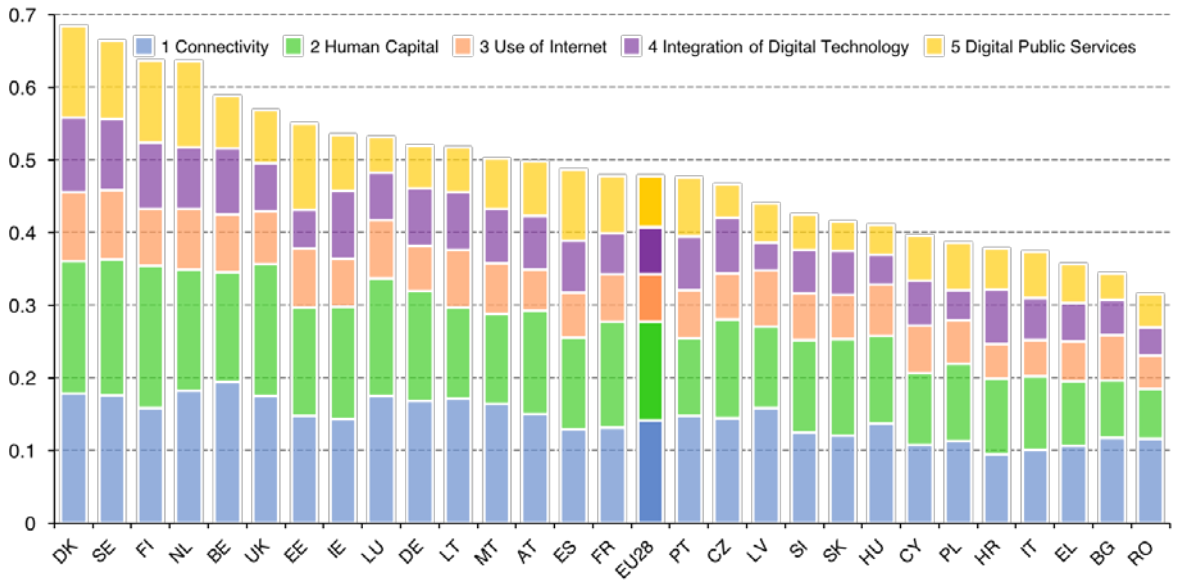
In the context of the Digital Agenda for Europe, the European Commission summarises the relevant indicators of Europe's digital performance in the '**Digital Economy and Society Index**' **(DESI)**. The Digital Economy and Society Index is an index based on indicators that measure Europe's digital performance and competitiveness.

The five dimensions of the DESI give a clear overview of the different aspects of digitalisation:

- **Connectivity:** this dimension mainly refers to the deployment of the broadband infrastructure.
- **Human Capital:** this dimension covers the required skills to fully benefit from the digital society. These skills can range from very basic user skills for daily functionalities online to advanced skills to enhance productivity and economic growth.
- **Use of Internet:** this dimension refers to the different types of activities that citizens engage in online.
- **Integration of Digital Technology:** this dimension measures the digitalisation of businesses.
- **Digital Public Services:** the last dimension indicates the degree of digitalisation in public services (e.g. eGovernment).

These five dimensions reflect the broad scope of digital performance, ranging from infrastructure aspects, skill levels, consumption, and impact on businesses and the public domain. Within this broad range, there is also a different degree of digitalisation between EU Members states. Figure 2 gives an indication of the large variety of digital integration between countries.

Figure 2: DESI 2015



Source: European Commission (2015)

Although there has been some convergence in the digital competitiveness of the Member States since the first DESI, Figure 2 shows the uneven development across the European Union. Based on this index, countries can be clustered in to high, medium and low performance groups:

- The **highest performing countries** are considered world leaders in digital competitiveness. This cluster consists of the Scandinavian countries and The Netherlands.

- The **medium-performance group** are countries that are doing well in certain areas, but still need to progress in others. Belgium, the United Kingdom, Estonia, Luxembourg, Ireland, Germany, Lithuania, Spain, Austria, France, Malta and Portugal are in this group.

- The **low performing countries** are lagging behind and need to catch up with the other Member States. The Czech Republic, Latvia, Slovenia, Hungary, Slovakia, Cyprus, Poland, Croatia, Italy, Greece, Bulgaria and Romania are categorised in this cluster.

The average score in the European Union for 2015 is 0.48, with connectivity and human capital being the strongest dimensions. There is however room for improvement when it comes to use of the internet by citizens and the integration of digital technology by businesses. The scores for digital public services are very divergent, with a gap of 0.6 (on a 0 to 1) scale between the best and the worst performer. In general, all member states have improved their score when compared to last year, but the differences between the countries remains significant.

These differences are labelled as the '*digital divide',* which can be defined as the inequality in the integration of ICT. This digital divide should be taken into account when analysing the impact of digitalisation on the European labour market.

3. THE IMPACT OF DIGITALISATION ON JOB DYNAMICS

KEY FINDINGS

Digitalisation has diverse and **opposing effects** on job dynamics.

On the one hand, it enables economic mechanisms such as the development of new products, machines and increased competitiveness, which lead to the creation of **new jobs**. The impact on job creation per sector varies strongly, depending on the effect of digitalisation on the business model, the potential clients, the production cost and the overall organisation. These indirect effects could have a positive impact on sectors such as retail and hospitality. The direct effect of digitalisation is measurable in the ICT sector. The sector is expected to grow from 7.4 million employees in 2012 up to 7.9 million in 2020.

On the other hand, digitalisation and the related automation can substitute parts of or entire jobs and thus lead to **job losses**. Studies estimate that 35% to 60% of jobs in the EU are at risk due to digitalisation-induced automation. Medium-skilled jobs, such as office and administrative support work, manufacturing, transportation, etc. are considered to be most at risk.

Digitalisation also leads to the **relocation of jobs**. Cloud technology and automation make it easier to outsource jobs and tasks, not only to emerging countries with lower labour costs, but also to more specialised locations and workers. However, the impact so far should not be overestimated: studies show that the overall impact of offshoring on ICT jobs is limited to 0.8% of the total ICT jobs that were lost in 2012. The same goes for crowd working, which could also lead to jobs moving internationally, but is at the moment relatively new and marginal in Europe. Its growth potential however is large, since portions of almost all jobs could be performed by the crowd.

Overall, the **net impact** of digitalisation on jobs is **ambiguous** and leaves room for debate. Cedefop forecasts the creation of 8.5 million knowledge and skill-intensive jobs and 2 million in more elementary occupations. Conversely, 4 million jobs will disappear, primarily in skilled manual work. However, these are only estimates and the exact role of digitalisation in this is unclear.

3.1. Introduction

Digitalisation could entail **major processes of change and restructuring** in all sectors and occupations, but particularly, in the service sector. Services have long been seen as supporting other parts of the economy and as a mostly passive user of new technologies.

However, the advent of the internet, combined with the liberalisation of telecommunications services, has changed the role of services substantially and induced major changes to job dynamics[1].

Debates on the impact of digitalisation on the number of jobs divide between the **minimalists** (who believe little will change) and the **maximalists** (who believe that everything will):

- The **minimalists** consider that we are entering an era of low economic growth where new technological developments, such as digitalisation, will have limited impact.
- The **maximalists** predict important economic shifts in employment due to technological progress.

Between these two extreme points of views, we can consider that digitalisation changes the prompts the following relevant job dynamics:

- New Jobs created
- Jobs lost
- Jobs moved internationally
- Jobs transformed

These different job dynamics are discussed below. Finally, based on the existing evidence, we try to identify the net impact of digitalisation on job dynamics.

3.2. New jobs created

3.2.1. Job creation effects

The economic literature identifies two competing effects of technological progress on employment. On the one hand, technology can substitute for labour and hereby 'destroys' labour (see 3.3). On the other hand, we see job creation caused by a variety of effects. The following **economic mechanisms** explain the emergence of new jobs (Spiezia and Vivarelli, 2002):

- *"New products"*: New economic branches can be developed, which deploy new demand for labour. Digital entrepreneurship is a key factor here. For example, Big Data architects, iOS developers, digital marketing specialists and data scientists are all jobs that barely existed five years ago. Another illustrative example is the mobile app industry, which emerged in 2008, and has been an area of spectacular growth (OECD, 2014).

[1] The concept of job dynamics in this context refers to the total volume of jobs in an economy, with attention for the possible shifts within this total volume.

- *"New machines"*: the new technology requires new infrastructure and machines, which have to be produced by employees, which generates new jobs (e.g. 3-D printing).

- *"Increased competitiveness*": productivity gains caused by the new technology result in a lower unit cost of production, which increases the competitiveness of a sector and the market share.

3.2.2. Sectoral impact

Not every sector will be affected in the same way and degree by digitalisation. Although digitalisation positively affects productivity across sectors, its impact on employment is uneven. To understand the impact at sectoral level we have to differentiate between the **different company functions**:

- *Market:* digitalisation changes business models by lowering barriers to entry and expanding market reach.

- *Potential clients:* digitalisation is redefining the way in which businesses address their (potential) clients.

- *Production costs:* companies are radically shifting their labour-intensive tasks to emerging countries, while other aspects stay local.

- *Organisation:* digitalisation has and is still changing the concept of work organisation, for example by making telecommutes and homeworking a popular way of working.

The interaction between these company functions determines the type and extent of the impact of digitalisation. If digitalisation mainly has an effect on the efficiency of the production, but not on potential clients, the sector is likely to lose jobs. On the other hand, if the market access is improved, job growth will be more likely.

Strategy& (2013) examined five key economic activities in developed markets to gain insight on the dynamics between the company functions that are affected by digitalisation. To do this, they measured the growth in industry output, industry productivity and employment created by a 10% increase in digitalisation[2].

Applied to the different sectors, digitalisation is estimated to:

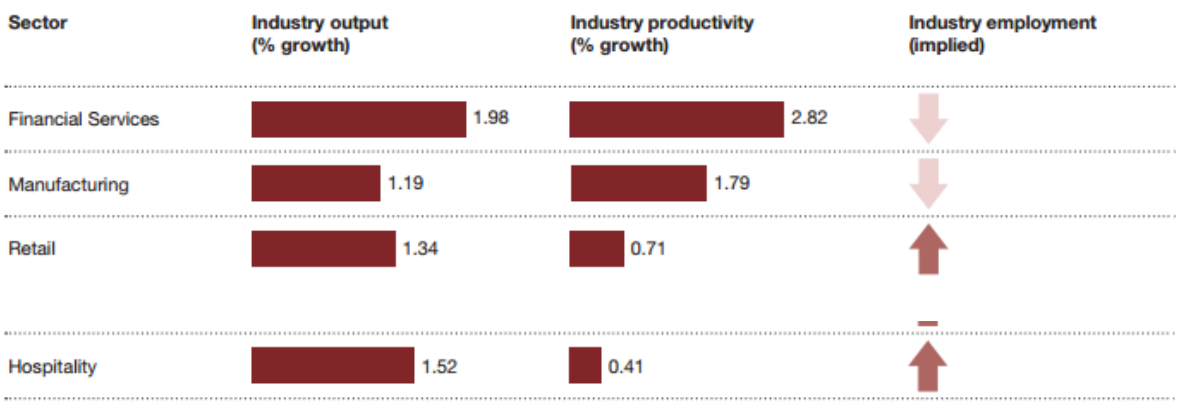
- **Create jobs** in services subsectors, particularly in hospitality and retail (especially e-Commerce[3]). In both sectors, because of the enhanced reach, the supply chains become more complex and require more people to manage them.

[2] Strategy&'s Digitization Index calculates the level of a country's digitisation on a score from 0 to 100, based on 23 indicators to measure the following six key attributes: ubiquity, affordability, reliability, speed, usability and skill.

[3] See also sector cases in chapter 3.

- **Reduce jobs** in the financial sector and the manufacturing sector because the productivity gains surpassed the output gains.

Figure 3: Impact of digitalisation on output, productivity and employment



Source: Strategy& (2013)

It is important to keep in mind that while on a macroeconomic scale employment can be measured, the role of digitalisation in the job dynamics remains a rough estimate. The exception to this is the **ICT sector**, where the jobs are directly related to digitalisation. The data from Gareis et al. (2014) shows the actual and increasing importance of the ICT sector in European employment. In 2012, the ICT sector accounted for 7.4 million workers or 3.4% of the total European workforce. If the conditions remain the same, the number of employees in the ICT sector could grow to 7.9 million in 2020. These employees are not only ICT practitioners, but also consist of roughly 2 million ICT management level employees. The demand for ICT employees will also rise exponentially. Gareis et al. (2014) estimate that the excess demand could reach 913,000 jobs by 2020.

3.3. Jobs lost

The digital revolution is changing the labour market fundamentally. Technology can replace tasks that used to be performed by individuals.

A recent study that focussed on potential job losses stated that 35% of today's jobs in the UK are at high risk of disappearing over the next two decades as a result of technology (Sproul, Knowles-cutler, and Gentle, 2014). These predictions are made based on the model of Frey and Osborne (2013). The jobs most at risk are considered as medium-skilled jobs:

- office and administrative support work;
- sales and services;
- transportation;
- construction and extraction;
- production (manufacturing).

Their model builds on three 'bottlenecks' that reduce the risks of job loss because of automation: the skills of perception and manipulation; creativity; and social intelligence (Autor et al., 2003).

Estimates by the think tank Bruegel (2014) based on similar assumptions indicate that 40 to 60% of the jobs in the EU Member States are at risk during the next twenty years due to digitalisation-induced automation. In former stages of industrial development productivity gains resulted in overall employment growth. According to them, because of the drastic and fast nature of digitalisation, it remains doubtful if a fully digitalised economy produces sufficient demand for labour to compensate for the expected job losses.

Digitalisation-induced automation goes beyond simple routine tasks. Although Levy and Murnane wrote in 2003 that driving in traffic could not be automated because of the complexity of human perception, Google announced its autonomous car in 2010.

Moreover, not just individual tasks, but entire industries are being transformed by digital technologies, e.g. the financial sector and the manufacturing industry (see above). Digitalisation also sometimes brings down leading players in the industry. At its peak in 1988, Kodak had 145,300 employees. In 2012, this was down to 13,100, due the new market for digital photography (The Atlantic, 2012). These jobs are not all lost, since the loss of market share leaves room for multiple smaller firms to blossom.

3.4. Jobs moved internationally

Digital technologies such as cloud technology, together with standardisation and automation, make it easier to outsource tasks, not only to more specialised locations or workers but also to emerging countries with lower labour costs. This could possibly cause direct job losses in one country, but job gains in another.

Specifically for the ICT sector, global sourcing has led to some ICT work being offshored to countries outside of Europe with cost reduction as a key driver (McLaughlin et. al, 2014). While offshoring is also used to gain access to specific capabilities that may be in short supply locally or onshore, cost savings are still a major factor.

But outsourcing does not necessarily cause direct job losses. Evidence suggests that the impact on jobs in the ICT sector is limited. A possible explanation is that ICT staff are redeployed and new ICT positions may also be opened up by offshoring vendors that want to expand their businesses in the EU by establishing a physical local presence to better serve their EU customers (McLaughlin et. al, 2014).

(McLaughlin et. al, 2014) estimate that on average 22% of total jobs impacted by offshoring are lost. Moreover, empirical studies show that as offshoring matures, the number of jobs lost onshore in terms of total jobs moved decreases. McLaughlin and colleagues estimate that by the end of 2020, the number of ICT jobs lost due to offshoring will represent 17% of total ICT jobs moved. In absolute terms, this means that some 60,400 EU jobs were lost by 2012 and some 132,900 jobs are forecast to be lost by 2020 (see Table 1).

Table 1: Total ICT Jobs lost

	2012	2014	2016	2018	2020
France	6,400	8,400	10,800	13,800	17,500
Germany	10,200	13,200	16,900	21,500	27,100
Italy	1,500	1,900	2,500	3,200	4,100
Poland	1,800	2,000	2,300	2,500	2,800
Spain	3,000	3,500	4,100	4,800	5,600
UK	26,700	31,000	35,300	39,900	44,900
EU21	10,800	14,400	18,800	24,400	30,900
Total EU	60,400	74,400	90,700	110,100	132,900

Source: (McLaughlin et. al, 2014).

When compared to the total number of ICT jobs, the jobs lost by outsourcing only represented around 0.8% in 2012. This varies from country to country, with only 0.2% of the total ICT skills demanded being lost in Italy, rising up to 1.6% in the UK. While the impact of outsourcing in ICT is rather limited, it is expected to rise significantly (McLaughlin et. al, 2014). It is unclear if the same trends apply to sectors other than ICT.

Crowd-working can also play a significant role in this trend of outsourcing. Howe (2006) describes crowd-working as "*the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call".* This new way of work is described in detail in section 4.3.3.

3.5. Transformed jobs

Technology and digitalisation also bring about transformations in existing jobs, by completely changing the working conditions (e.g. crowd workers) or the skills needed to perform the job. This is discussed in chapter 4 and 5.

3.6. The net impact of digitalisation on job dynamics

Some recent studies estimated the net impact of digitalisation on job creation, by taking into account new jobs, lost jobs and moved jobs. 'Strategy&' (2013) claims that digitalisation was responsible for the net creation of 213,578 jobs in Western-Europe. This number is rather low compared to developing economies, because – according to this paper - in developed economies, a large part of labour intensive tasks moved to countries with lower labour costs. Moreover, another proportion of the jobs disappeared because of digitalisation and automation.

Cedefop's latest forecast (2010) of the skills demand and supply in Europe estimates that the net growth of jobs will be around seven million by 2020. Digitalisation is not the only driver in this growth, but it is considered as one of the key factors explaining the creation of these new jobs.

Most new jobs, projected to be around 8.5 million, will be in knowledge- and skill-intensive occupations, such as high level managerial and technical jobs. At the lower end of the skills spectrum, demand for elementary occupations is expected to increase by around 2 million.

But over 4 million job losses are forecast for skilled manual workers. Many of these are likely to be routine jobs replaced by new technologies. These changes signal a risk of job polarisation, with increased demand at the upper and lower ends of occupations, and decreases or stagnation in the middle.

We can thus conclude that the net effect of digitalisation for the jobs in Europe remains ambiguous and would need further research.

4. THE IMPACT OF DIGITALISATION ON WORKING CONDITIONS

KEY FINDINGS

Digitalisation prompts major transformations in how work is organised and employment relationships. This stimulates evolutions at a micro-economic level (at the level of companies and individuals) but also at a macro-economic level (at the level of the labour market and society).

At a micro-economic level, workers have the flexibility to **work anytime and anyplace**. This could help workers to improve their work-life balance. It also has positive consequences for the employment of people seeking for more flexible work arrangements (women, older workers, but also less mobile people).

Digitalisation and time- and place-independent work also encourages **new ways of working flexibly** and new types of employment relationships, such as telecommuting or telework, freelance work or independent professional (iPro), crowdsourcing and employment in the shared economy. However, there are still **no clear definitions** of these new ways of work, which makes it difficult to collect data and monitor these phenomena.

Anytime and anyplace working offers opportunities to develop worker-friendly forms of flexibility but also has some **negative side effects,** especially for workers. For example, the increased intensification of work and the obligation for workers to always be available may cause stress and burn-out. Moreover, there are also concerns about access to social protections for workers under these flexible work arrangements.

At a macro-economic level, digitalisation is also leading to the gradual **polarisation of employment** in terms of work autonomy and wages, inducing increased inequalities. Jobs are more likely to be situated at either the high or the low end of the wage and autonomy distribution, with a declining number of jobs between the extreme poles.

All the evolutions in the working conditions at a micro-economic level also create major challenges for the **social security models** of EU countries. The social security models of most EU countries were developed in a period when male, full-time and fixed-term contracts were the dominant feature. Due to digitalisation, new flexible employment relationships are emerging and are resulting in atypical career patterns (e.g. freelance work). Policymakers will therefore face a significant challenge to bring their social protection mechanisms into line with the new flexible employment relationships and ensure social protection to all types of workers.

4.1. Introduction

The digital economy prompts major transformations in the organisation of work and employment relationships. These developments challenge the traditional understanding of employment, working time and place, and cause specific health and safety hazards. The digital economy could also lead to major transformations of the social security model in EU countries.

At a **micro-economic** level (companies and individuals), digitalisation induces the following important evolutions in the organisation of work.

- More time- and place-independent work for workers and companies
- New ways of working and employment relationships
- New issues concerning social protection, health and safety

The transformation in how work is organised also allows for major evolutions at a **macro-economic** level (at the level of the labour market and society):

- Polarisation of work autonomy and wages
- Major challenges for the social security model

All the evolutions at micro- and macro-economic level are discussed below.

4.2. More time- and place-independent work for workers and companies

One important transformation in how work is organised is the fact that workers and employers have the **flexibility to work at any time and in anyplace.**

Years ago, in the Industrial Age, work was restricted to 'set-time, set-place' barriers. All workers had to be in the same place at the same time in order to work. Today, with smartphones, free global videoconferencing and cloud-based document sharing, there are no barriers anymore and place and time of work are becoming increasingly irrelevant. In other words, work no longer needs to be a place. Both businesses and workers have more freedom and flexibility to work from anywhere (Swart, 2013).

As a result, workers and employers also have the **freedom to use time and space in another way** (Swart, 2013):

- **New ways of life:** With the ability to work from anywhere, people are able to live wherever they like, e.g. in a rural town with limited traditional employment. This flexibility also applies to how people spend their time. Professionals no longer have to choose between full-time work and spending time with their family. This has positive consequences on the employment of people seeking more flexible work arrangements (e.g. women and older workers) but also less mobile people.
- **Virtual companies and distributed teams:** A virtual company operates mostly or completely outside a traditional office environment and without a main office building. The workers of virtual companies – also called distributed teams - will

usually be working from home or co-working spaces. Virtual companies and virtual jobs are becoming more popular than ever before.

- **New office spaces:** More and more, offices serve as a gathering spot for a flexible workforce, instead of a daily destination. As a consequence, office space designs shift towards open and shared environments that foster collaboration and creativity. *"Hot-desking",* which involves different workers using a single physical work station or surface, is gaining popularity as a way to use office space more efficiently.

4.3. New ways of working and employment relationships

Digitalisation and time- and place-independent work also introduces **new ways of working and new types of employment relationships**:

- Telecommuting or telework
- Freelance work or independent professional (iPro)
- Crowdsourcing
- Employment in the sharing economy

For each of these types of employment relationship we provide a short description below, some statistical evidence and the consequences in terms of working conditions.

4.3.1. Telecommuting

i. Description

Telecommuting or telework is a practice in which a worker works outside the company buildings. This is usually at home, but can also be at other locations (e.g. co-working spaces). When telecommuting, an employee maintains contact with co-workers and supervisors via existing forms of communication technologies (i.e., mail, telephone, videoconference, etc.). Due to digitalisation and ICT innovations telecommuting has become more popular in many companies.

ii. Statistical evidence

As telework is relatively new, reliable statistics on this form of work remain limited. According to the latest data of the EWCS, the **average proportion of employees involved in telecommuting** was about 7% in 2005 for the EU27, while it reached 5.3% in 2000 (Eurofound, 2010). The use of telework is clearly growing in almost all EU countries.

However, the use of telework **varies substantially between EU countries**. The highest percentage of teleworkers is observed in the Czech Republic (15.2%) while the lowest rate is observed in Bulgaria (1.6%). Above average numbers of teleworkers are also observed in the Benelux countries, the Nordic states and some other new EU Member States (Estonia, Latvia, Poland). In terms of **sectors**, a higher use of telework is observed in real estate, financial intermediation and education (15%). The figures also show that higher skilled workers are more likely to use telework.

Looking at the **profile of teleworkers**, it seems that they are mostly males rather than females (8.1% versus 5.8%). However, according to Eurofound (2010), the gender differences may be partly explained by the sectoral distribution of telework. Finally, it seems that telecommuting is mostly performed on a part-time basis, which suggests that telework is used to increase the flexibility of the employment relationships rather than being used as a full-time way of working.

iii. Working conditions

The first agreement for telecommuting in the European Union was signed in July 2002. This European Framework Agreement on Telework defines that *"Telework is a form of organising and/or performing work, using information technology, in the context of an employment contract/ relationship, where work, which could also be performed at the employer's premises, is carried out away from those premises on a regular basis"* (European Social partners, 2006).

The agreement stated that teleworkers enjoy the same general protection as employees. It identifies the aspects which are specific to teleworking and highlights areas requiring special attention, e.g. data protection, privacy, equipment, health and safety, work organisation, training and collective rights.

The literature agrees that both employers and employees can benefit from telecommuting. According to Reference for business, different positive factors, including health issues, can be observed, in particular:

- *Happier employees*. Telework can improve the quality of life of workers, by giving them the opportunity to avoid stressful commutes and thus to gain time for other activities, e.g. child and elder care.
- *Increased retention*. Telecommuting can be a way to retain workers.
- *Increased employee productivity*. Studies suggest that employees are more productive at home, where interruptions and meetings are avoided.
- *Cost savings*. Companies can reduce the office space and parking space costs.

Even if various positive factors of teleworking can be identified, there are also some **negative side effects** associated with this way of working, for employers as well as for employees. Commonly cited drawbacks in the literature for **employees** include the following (ILO, 1990):

- Telework can affect the *physical and psychological* wellbeing of workers by separating them from their co-workers.
- Telework may generate *isolation and stress* and have an adverse impact on morale.
- Teleworkers could possibly have *reduced access to training*, which could have a perceived *damage to their career*.
- Telework could generate health issues associated with the blurring of the boundary between work and private life.

On the **employers' side**, telework can also generate the following negative side effects:

- Some employers consider that it is more difficult to *supervise* workers when they are working at home than when they are working at the office. Teleworkers need to be managed through objectives and tasks, not by the number of productive hours.
- Telework could lead to *diminished productivity* for people unable to be productive at home.
- Telework causes *security problems* for company information.
- Telework could lead to the *erosion of company culture and loss of brainstorming ability*.

In recent years an increased number of studies have appeared analysing the impact of teleworking. Most confirm the positive impacts of this new way of working. For example, Bloom, N et al. (2012) observed substantially higher work satisfaction and an increase of 12% in the performance of teleworkers, of which 8% was linked to the fact that teleworkers worked more hours and 3% was linked to a higher performance per hour.

4.3.2. Freelance work or independent professional (iPro)

i. Description

Digital technologies enable fragmented business models, as information can be shared across large distances and audiences at lower cost. As a result, businesses can now hire specialists on demand and keep their workforce flexible in response to fluctuations, for example in the form of self-employed workers or freelance workers.

ii. Statistical evidence

Freelancers or iPros are defined as "*highly skilled self-employed individuals who work for themselves but do not employ others*" (Leighton and Brown, 2014, pg. 1). However, there is no data identifying the number of freelance workers separate to small independent businesses. Moreover, there is no minimum number of hours that must be worked in order to be considered as a freelancer.

When analysing **data on self-employment**, it seems that in the EU-27, the share of self-employment as a percentage of total employment is rather steady. Between 2000 and 2013, self-employment decreased by only 0.2 percentage points in the EU-27, from 14.3% to 14.1%. In the EU-15, a decrease of 0.5 percentage points can be noticed from 1995 to 2013. The highest increase can be observed in Germany (1.6%) and in the Netherlands (5.1%). However, this data hides an increase in the number of freelancers and a decrease in the number of SMEs during this period of time (Eurociett/Uni-Europa, 2014).

However, according to Leighton and Brown (2014), **iPros** represent an important part of the labour market: 25% of professional, scientific and technical jobs and 22% of jobs in arts and entertainment. IPros are the fastest growing group in the EU, increasing from 6.2 million in 2004 to 8.9 million in 2013, which represents an increase of 45%. This increase is especially observable in the Netherlands, Poland and France. If we look at their profile, the majority of iPros are men (54% in 2012).

iii. Working conditions

According to a recent survey by Genesis Research, 90% of freelance workers consider that being a freelancer gives them more personal freedom than a traditional job, and 69% even said that the work is more interesting (Swart, 2013).

However, as mentioned by Leighton and Brown (2014), there are important issues in some EU member states in terms of **social protection for self-employed professionals**, especially compared to employees. There are restrictions in many EU countries on the entitlement of self-employed professionals to unemployment insurance and benefits related to sickness and disability. The main motivation for these restrictions are linked to the problem of monitoring the number of self-employed people. Without monitoring and enforcement, it is difficult to know if a self-employed worker has become unemployed or sick. Leighton and Brown (2014) consider that the legislation applied to self-employed workers is an adaptation of the existing legislation for the traditional employer/employee model and not specific legislation taking into account the distinct requirements of self-employed workers.

4.3.3. Crowdsourcing

i. Description

Different terms are used to refer to crowdsourcing, such as crowd working, collective intelligence, human computation, peer production, etc. Compared to outsourcing, where a company or person is selected to perform a job, crowdsourcing is more open and group-based. Workers who qualify for the task and want to carry it out, can participate. It is based on online platforms, where freelancers can compete for published tenders for work assignments.

"*While not all jobs are amenable to being sent down a wire, there are portions of almost any job that can be performed by the crowd*" (Holtgrewe, et. al., 2015). The largest part of today's crowd work is based on designating a small aspect of a task to each worker. Individually, these are mainly small, independent and homogenous tasks that don't require a high skill level. Crowd work does however have the potential to increasingly replace skilled labour, by decomposing work into even smaller pieces and by attracting workers with very specific skills. Kittur and colleagues (2013) claim that with the right process and technological support, not only speech transcription or copyediting can be performed by crowd workers, but also more complex tasks such as product design or translation. This could unlock career opportunities, even for skilled work, in online market places.

This trend towards a variety of required skill levels in crowd working can be illustrated by looking at the existing platforms for crowd work. The largest platform, Amazon Mechanical Turk (AMT), focusses on short and unskilled tasks. Newer platforms such as LiveOps however create virtual call centres for skilled tasks such as tech support by using a 'networked crowd' (Felstinerf, 2011).

ii. Statistical evidence

Crowd working is a relatively new topic. Most crowdsourcing research is currently published in conferences and "minor" journals and there is no meta-data available on the number of crowd working jobs.

A recent case study by Eurofound does provide valuable insights in the development of crowd work. In Europe, the phenomenon of crowd working has emerged since the late 2000s or early 2010s. Factors that induced and strengthened the growth of crowd work are new technologies, the growing importance of work-life balance and an increasing number of well-educated young professionals looking for other or supplementary forms of employment.

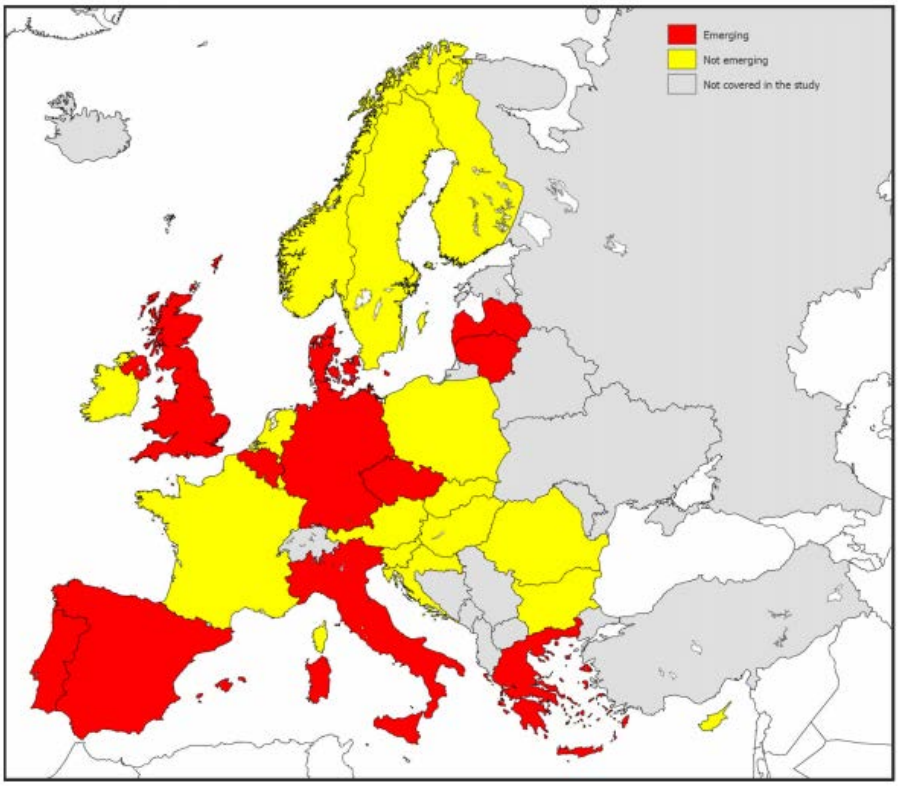
Although crowd working is a growing trend in Europe, its short term economic impact should not be overstated. The largest platform in Spain is estimated to have around 135,000 workers all over the world, but other European platforms such as Topdesigner.cz and Lingjob have more in the range of 3,000-4,000 workers (Eurofound, 2015). Non-European platforms such as Amazon Mechanical Turk have around 500,000 'providers' that work for a broad range of requesters, but a study by Fort and colleagues (2014) concluded that the number of active workers was more likely between 15,059 and 42,912. 80% of the work is performed by an even smaller group of 'Turkers', ranging from 3,011 to 8,582 workers. Based on this, it is safe to assume that the number of active crowd workers in Europe is substantially lower than the reported numbers.

The profile of these active workers has changed drastically over the years. While the average 'Turker' used to be a primarily moderate-income US-based worker, the largest group nowadays are young and well-educated Indian workers (Fort et al., 2014). For them, 'Turking' is increasingly becoming a full-time job and provides them with an income. The profile of the workers on the European platforms is also that of young, well-educated professionals, but most of them consider it as a spare-time activity and not as a full-time job.

The indirect impact on job dynamics in Europe is hard to assess, but this seems a rather peripheral phenomenon at the moment given the fact that European crowd workers don't consider it as a full-time job and that the number of active, European workers on the platforms is limited. The same goes for the direct impact. This is illustrated by the fact that even one of the larger platforms, such as The German Clickworker platform, only has 26 employees (Eurofound, 2015).

The importance of crowd working is also very divergent across the European Union. Figure 4 illustrates this. Because of the lack of complete data, a comprehensive analysis is not yet possible. However, some interesting results emerge. Eurofound states that the recent crisis in Greece and Spain led to the need to find alternative ways of offering one's services and thus to a stronger growth of crowd working. In the Scandinavian countries, although these countries score high on digitalisation indexes such as DESI, crowd work is not yet emerging.

Figure 4: Importance of crowd working in European Countries



Source: Eurofound, 2015 (based on national contributions)

iii. Working conditions

Crowd working provides both opportunities as well as risks when it comes to working conditions.

The **main advantages** are listed below:

- The possible increase in the **level of autonomy of the workers** is often indicated as the main advantage of crowd working (Eurofound, 2015). While this is true, it also includes a risk of stress induced by the need for self-organisation and the blurred line between work and private life.

- Crowd working can enhance **social mobility** in regions or countries where the local economy has not yet reached its full potential. The well-educated Indian crowd workers who use the platform as a primary source of income illustrate this.

However, there are also **large risks** associated with crowd sourcing:

- The main risks associated with crowd working are the **lack of regulatory framework**. Regulation can't always keep up with emerging innovations. This also seems to be the case for crowd working (Felstinerf, 2011). Because of the declining relevance of location, crowd working causes new legal challenges, especially when it comes to social protection of workers. Contracts are less

enforceable than in traditional workplaces (Silberman et al., 2010). Crowd workers don't get benefits such as training and don't have the regular social protections because they are considered to be self-employed or freelancers (Felstiner, 2011). Because of the lack of regulation, intellectual property rights are also based on the agreement between employer and employee or the terms and conditions of the platform (Klebe and Neugebauer, 2014). Intellectual property rights are often owned by the employers, so crowd workers are unable to build a portfolio.

- The other main risk is associated with **low wages**. The global competition makes workers easily replaceable. Workers from countries with a lack of social protection and low wages have a competitive advantage and put a downward pressure on working conditions (Kittur et al., 2013). The average wage at Amazon Mechanical Turk is $2 per hour, without benefits or social protection (Ipeirotis, 2010). On top of this, there is insecurity of pay. Crowd workers are vulnerable to employers denying the workers' pay because they are not satisfied with the results. While this system offers a solid protection for employers, employees are left without a secure income.

- Kittur et al. (2013) call the trend towards organisation forms that optimise efficiency, without consideration of education or social protection, a new form of Taylorism. They fear that the lack of commitment between employers and employees in crowd work could lead to **more exploitation**.

4.3.4. Employment in the sharing economy

i. Description

With the digitalisation of the economy, a new business model has been developed, called the sharing economy. This model consists of digital online platforms, which bring together customers and providers in order to share their own goods, services and skills. The core of the sharing economy is that it brings people together in order to rent or use things from each other.

According to an article in the Economist of March 2013, the sharing economy model works for items that are expensive to buy and are not fully used by their owner. Bedrooms and cars are the most obvious examples, but it is also possible to rent camping spaces, washing machines, as well as offices and machines for companies. The sharing economy also brings together people who need specific skills, e.g. a housecleaner or a handyman with providers willing to supply it. This model is thus linked to the concept of crowdsourcing.

ii. Statistical evidence

There is no clear definition of the sharing economy and even less of employment in the sharing economy. In many cases, the nature of the employment relationship and legal status of the parties involved remains unclear, which makes it difficult to monitor these phenomena.

According to a study by PwC (2015), 7% of U.S. adults say they are working on sharing platforms. There is no similar data available for the EU.

iii. Working conditions

As the nature of the employment relationship and legal status of the parties involved in the sharing economy is unclear, it is difficult to evaluate working conditions. According to an article in the Wall Street Journal of May 2015, "*critics worry that sharing platforms may seduce underemployed and economically weak people into jobs with no benefits and few protections. Others say sharing-economy jobs provide different types of workers with something they value more than benefits: flexibility and autonomy*".

According to this article, the workforce in the sharing platforms falls into four groups:

- **The flexers,** e.g. parents, retirees, students, people with disabilities and others for whom the traditional nine-to-five job is not an option. "*The flexibility and autonomy offered by the sharing economy allow this group to be in the workforce*" (Wall Street Journal of May 2015).

- **People who cannot find a traditional job** and use the sharing economy to generate some independent income.

- **The professionals** who, by providing brand, marketing, support and distribution services, have made a full-time job from sharing platforms.

- **The traditional full-time workers** seeking to earn extra income.

Even if employment in the sharing economy may be attractive to different groups of people, it is clear that the legal status and access to social protection of this employment is very limited.

4.4. New issues concerning social protection, health and safety

Anytime and anyplace working offers opportunities to develop worker-friendly forms of flexibility but also comes with some negative side effects and confronts companies with **new questions regarding social protection, health and safety issues:**

- **Risk of turning "anytime – anyplace" work to an "always and everywhere" obligation for workers**: The use of modern information and communication technologies is breaking down the boundaries of work, with a new openness in terms of the location of work, when work is carried out and how it is organised. However, according to different experts, this creates risks if employees are, or feel obliged to remain, available for work at all times, through emails and phone calls. Such "work without boundaries" may cause stress and burn-out which incur considerable costs on workers and employers (German Federal Ministry of Labour and Social Affairs, 2015).

- **Work intensification:** Multitasking and information overload are resulting in work becoming highly intensive. Trying to figure out which information is important and what can be ignored is exhausting. At the same time, we are all doing more. "*Thirty years ago, travel agents made our airline and rail reservations, salespeople helped us find what we were looking for in shops, and professional typists or secretaries helped busy people with their correspondence. Now we do most of those things ourselves. We are doing the jobs of 10 different people while still trying to keep up with our*

lives, our children and parents, our friends, our careers, our hobbies, and our favourite TV shows" (the Guardian, 18 January 2015).

- **Legal vulnerability:** Different new ways of work raise legal concerns . For example, some legal issues regarding telecommuting have yet to be completely settled, such as the employer liability for home-office accidents and responsibility for equipment located in the home. Legal concerns are even more important for employment in the sharing economy and crowdsourcing. In many cases, the nature of the employment relationship and legal status of the parties involved remains unclear (EESC, 2015).

- **Absence of social protection:** Most new ways of work are also characterised by limited access to social protection, e.g. crowd working and employment in the sharing economy is exempt from national labour law and is not covered by fundamental social rights. In many EU countries there are also important restrictions on the entitlement of self-employed professionals and freelancers to social protection, and more specifically to unemployment insurance and benefits related to sickness and disability.

- **Possible threat to collective bargaining power:** During a conference on "Employment and social security in the Digital Single Market: Chances and Challenges", Valerio de Stefano from the International Labour Organisation (ILO) stated that the increasing share of outsourced work could form a threat to freedom of association and collective bargaining.

4.5. Polarisation of employment in terms of work autonomy and wages

At a macro-economic level, digitalisation is leading to the gradual **polarisation of employment in terms of work autonomy and wages**. Jobs are more likely to be situated at either the high or the low end of the wage and autonomy distribution, with a declining number of jobs between the extreme poles (CEDEFOP, 2010). This evolution has been confirmed by many other studies (e.g. Goos, et al. 2013).

The tasks performed by highly qualified professionals can typically be carried out remotely by use of mobile digital devices and at any time of the day, enabling practices such as telework and crowdsourcing, and facilitating freelance work. Such flexible types of work organisation typically provide employees with high levels of work autonomy and thus have the potential to improve job quality and work-life-balance, and to facilitate the reconciliation of work and family life (EESC, 2015).

In other low skilled sectors, job autonomy is decreasing through services digitalisation. This occurs, for instance, in the retail sector where highly routinized jobs are created in e-Commerce logistics centres. Yet, the quality of such work is often perceived to be low and these jobs are characterised by low wages (EESC, 2015).

This could lead to a gradual polarisation of employment in terms of work autonomy and wages, creating increased inequalities.

4.6. Major challenges for the social security model

All the evolutions in working conditions at a micro-economic level finally induce major challenges for the **social security models** of EU countries.

The social security models of most EU countries were developed in a period when male, full-time and fixed-term contracts were the dominant feature. Due to digitalisation, new flexible employment relationships are emerging and are resulting in atypical career patterns (e.g. freelance work).

As described below, most new ways of work are characterised by limited access to social protection, e.g. crowd working and employment in the sharing economy is exempt from national labour law and is not covered by fundamental social rights. In many EU countries there are also important restrictions on the entitlement of self-employed professionals and freelancers to social protection.

The contribution to the social security system made by the workers employed in these new forms of work are often smaller or even nonexistent compared to those in traditional forms of employment. The increase in these new ways of working could therefore put major strains on the public fiscal system of the EU countries. Policymakers will therefore face a significant challenge to bring their social protection mechanisms into line with the new flexible employment relationships and ensure social protection to all types of workers.

5. THE IMPACT OF DIGITALISATION ON SKILLS REQUIREMENTS

KEY FINDINGS

The need for medium-skilled workers is expected to decrease, while the need for lower-skilled and higher-skilled workers will increase due to the digitalisation of labour. In such a **polarised labour market**, medium-skilled workers will need to upgrade their skills to be employable and to qualify for higher-skilled jobs. However, beside older workers and people with lower than upper secondary education they are one of the groups who most lack e-skills.

Data from the European Commission show that one in two workers in the European Union have insufficient e-skills, which is highly problematic because of the direct, positive relationship between e-skills and competitiveness. Furthermore, the number of **bottleneck vacancies** is expected to increase up to 900,000 vacancies by 2020 in ICT-related sectors, while e-skills are also needed in other sectors and occupations, as well as in the job search process. As well as e-skills, other generic skills like social intelligence and computational thinking will become more and more important to be employable.

Supplying all required skills requires **changes in vocational education and training**. Investments in ICT infrastructure and broadband support the use of new learning methods like Massive Open Online Courses (MOOCs). Yet, Eurostat data underline the importance of workplace training for learning e-skills, since formal educational institutions mainly only reach young people. Content wise, education and training programmes particularly focus on science, technology, engineering and mathematics (STEM) in order to close the skills gap.

5.1. Introduction

The European Commission's Digital Agenda for Europe entails multiple recommendations, including the promotion of e-skills for the efficient functioning of the future labour market. The underlying reasoning is the almost one-to-one relationship (i.e. a correlation of 85%) between e-skills and competitiveness (Titan et al., 2014). Digitalisation induces major evolutions in the skills needed, through different channels:

- Low- and high-skilled workforce in a polarised labour market
- E-skills within each occupation
- E-skills required for job searching
- New generic skills

- Adapted and digital vocational training

5.2. Low- and high-skilled workforce in a polarised labour market

As stipulated throughout this report, the increasing digitalisation has important implications for the labour market in terms of demand for low-skilled, medium-skilled and high-skilled workers (Dolphin T. (ed), 2015):

- The demand for **high-skilled workers** will increase as it is up to them to handle new technology and to supply the expertise that is required to interpret the data that new technology produces. Dolphin and colleagues (2015) expect a higher need for skilled jobs like "database administrators, network technicians and webmasters, planners, big data analysts, etc." Furthermore, they stipulate that the number of jobs is expected to increase in relatively higher-skilled industries providing ICT-related products or services, for instance related to software or digital entrepreneurship;

- The increasing automation of business processes reduces the jobs targeting **medium-skilled workers**. At the same time, the number of jobs is expected to decrease in industries that traditionally employ many medium-skilled worker. Based on this reasoning Dolphin and colleagues (2015) expect a decrease in jobs for medium-skilled professions like "manufacturing production workers, data-entry clerks, mail sorters, workers in book and music stores, etc.";

- Growth in organisations providing low-skilled services, like app-based taxi services, as well as the decay of medium-skill jobs boost demand for **lower-skilled workers**.

The lower need for medium-skilled workers is also discussed in the 'World employment and social outlook: Trends 2015' published by the International Labour Office (ILO). The report confirms the recent trend that medium-skilled routine jobs like bookkeeping, shoemakers and carpenters are more and more in decline. This phenomenon coincides with the increasing demand for lower-skilled workers performing physical jobs (such as security personnel) and higher-skilled workers doing non-routine jobs (e.g. legal representatives) (Autor, 2010).

Such polarisation is reflected in the type of qualifications companies are looking for. Consequently, workers who are employed in disappearing medium-skilled jobs gradually need to either upgrade their skills and target high-skilled jobs or compete for lower-skilled occupations. In order to avoid the lower-end of the labour market or unemployment, it is crucial that medium-skilled workers do and are able to evolve to become higher-skilled workers and qualify for higher-skilled jobs.

5.3. Increased need for e-skills within each occupation

According to Eurostat's glossary, e-skills or electronic skills include "those skills needed to make use of Information and Communication Technologies (ICT) as well as those skills required to apply and develop them". A distinction is made between three types of e-skills: ICT practitioner skills, e-business skills and ICT user skills:

- **"ICT practitioner skills** are the capabilities required for researching, developing, designing, strategic planning, managing, producing, consulting, marketing, selling,

integrating, installing, administering, maintaining, supporting and servicing ICT systems."

- **"e-Business skills** correspond to the capabilities needed to exploit opportunities provided by ICT, notably the internet; to ensure more efficient and effective performance of different types of organisations; to explore possibilities for new ways of conducting business/administrative and organisational processes; and/or to establish new businesses".

- **"ICT user skills are** the capabilities required for the effective application of ICT systems and devices by the individual. ICT users apply systems as tools in support of their own work. User skills cover the use of common software tools and of specialised tools supporting business functions within industry. This is also defined as 'digital literacy' or 'digital competence'." In this respect, Titan and colleagues (2014: 269) stress that every individual needs to develop "a universal area of competence for living, learning and working in the knowledge society".

Digital technologies are being introduced to a growing number of workplaces in the services sectors. As a consequence, workers will increasingly need to have both generic and specialised e-skills to accomplish their tasks at work and capture potential productivity gains. This need can manifest itself in something as simple as a small firm setting up a page on social media, or in larger ways such as the creation of entirely new occupations such as "data mining" to look for insights within large data collected by firms (OECD, 2014). For instance, according to Eurofound (2014), almost 60% of employees in the banking sector report the introduction of new technologies to their workplaces during the past three years.

Data from the OECD's Programme for the International Assessment of Adult Competencies (PIAAC) highlight the problem that a substantial amount of people lack the elementary e-skills to be employable in the increasingly digitalised labour market. Accordingly, statistics from the European Commission show that in the European Union almost half of workers (47%) have insufficient e-skills. At this rate, the number of vacancies that are hard to fill will continue to increase in ICT-related sectors, rising up to a predicted 900,000 unfilled vacancies by 2020 (EESC, 2015).

It is a universal phenomenon in EU Member States that at least one in ten adults do not master basic e-skills, such as the ability to use a mouse. Certain demographic groups are better prepared for the rapidly changing employment environment because they have stronger e-skills than others. In general, younger adults have near universal familiarity with computers (99%), but the majority of adults aged 55-65 do not know how to use a computer (57%). Educational attainment is also strongly linked to e-skills: only 4% of adults with a tertiary education have no computer experience, compared with 40% of adults with lower than upper secondary education. Furthermore, workers in skilled occupations are much more likely to have computer experience (93%) than people in semi-skilled blue collar occupations (54%) (OECD, 2014).

In sum, people aged 55-65, people with lower than an upper secondary level of education and people in semi-skilled occupations are most commonly associated with a lack of core skills and no computer experience. This pattern is problematic since these tend to be demographic groups at the most risk of losing jobs in the increasingly digitalised labour

market. As indicated above, semi-skilled workers are particularly likely to see their jobs disappear due to automation.

Nonetheless, according to the Survey of Adult Skills, nearly one in ten individuals aged 16 to 29 lack elementary e-skills. Taking into account that not only employment, but also job search increasingly requires the use of e-skills, the lack of ICT access or experience may put this particular group of young people at an important disadvantage. However, the acquisition of basic skills alone will probably not suffice to enhance and maintain one's employability, since these skills need to be accompanied by cognitive and other skills to create value. In this respect, the OECD's Employment skills outlook (2015: 34) refers to "creativity, communication skills, team work and perseverance". Moreover, the report indicates that young people use their skills (including e-skills) less than prime-age workers, even in similar occupations. This may be the case because young people are more likely to work in lower-skilled jobs or they may not be equipped with the specific e-skills that are required at work. Given the rapid pace of the digitalisation of the labour market, these skills quickly become obsolete. Not using and developing e-skills at work makes people vulnerable to being left behind technological change and reduces their chance of finding employment. (OECD, 2015)

5.4. Increased e-skills required for job searching

Both employed and unemployed job seekers require e-skills for gathering information on job vacancies and applying for jobs. Job matching and recruitment process increasingly make use of digital methods. Social media and new tools like applicant tracking systems, mobile recruiting, jobs boards and career pages are increasingly used by employers and job seekers. While job seekers can make more informed decisions by using these technologies, employers can reach a larger pool of potential applicants and carefully screen them (OECD, 2015). For instance, a study in various EU countries showed that approximately three in five companies used (or planned to use) social media as a hiring tool in 2013 (Society for Human Resource Management, 2013).

Moreover, a study on the US market provides evidence that the internet has improved labour market matching. Kuhn and Mansour (2014) found that online job search speeds up the time required to leave unemployment and find a job by about 25%, compared to more traditional offline job search. The internet is a one-stop job market for employers and job seekers that makes information available on a large geographic scale thereby reducing geographical mismatch.

As young people generally outperform older workers when it comes to e-skills, this may constitute an important barrier for older job seekers. Furthermore, highly qualified workers tend to search online when looking for work, which may aggravate inequalities between young workers. Additionally, since applicants are increasingly requested to have mobile access, people with limited access to computers or smart phones are in a less favourable situation.

5.5. New generic skills

Digitalisation also induces new needs for generic skills. In 2011, the Institute for the Future (IFTF) conducted a study to determine what skills one might need to be successful in a digitalised workplace. Among other things, the following crucial generic skills are identified and defined (IFTF, 2011: 8-12):

- **"Sense Making**: The ability to determine the deeper meaning or significance of what is being expressed. Critical thinking is one of the skills that machines do not have."

- **"Social Intelligence**: The ability to connect to others in a deep and direct way, to collaborate with others and to process information quickly and respond appropriately."

- **"Computational Thinking**: The ability to translate vast amounts of data into abstract concepts and to understand data-based reasoning."

- **"New-Media Literacy**: The ability to critically assess and develop content that uses new media forms, and to leverage these media for persuasive communication."

- **"Cognitive Load Management**: The ability to discriminate and filter information for importance, and to understand how to maximize cognitive functioning using a variety of tools and techniques."

- **"Virtual Collaboration**: The ability to work proactively, drive engagement, and demonstrate presence as a member of a virtual team."

In its report on "ICT skills and employment", the OECD (2011) states that in many cases, ICT skills need to be complemented with sector-specific skills such as business and administration skills. Generic and soft-skills (like communication skills) are also becoming increasingly important, sometimes surpassing even the need for pure technical skills thereby implying that employers ask for relatively high levels of experience and education. This makes it difficult for graduates to gain access to these jobs due to a lack of work experience.

5.6. Adapted and digital vocational education and training

The new skills needed due to the digitalisation of the labour market require reforms in initial vocational education and lifelong learning in order to provide both generic and specific digital skills.

Since technology keeps evolving at high speed, workers will increasingly need to keep investing in their skills. Apart from participating in formal education, this can be done by means of workplace training. Eurostat data for the EU-28 shows that 56% of all individuals have acquired e-skills by means of learning-by-doing, 51% obtained e-skills through informal assistance from colleagues, friends, etc. While acquiring e-skills through formal education was the third most popular learning method, only one in four individuals (28%) turned to schools, colleges, universities, etc. Young people were more likely to have acquired their skills through formal education providers (72% of 16 to 24 year olds compared to 5% of people aged 55 or older). These findings indicate that older are more likely to have obsolete or depreciated e-skills due to a lack of lifelong learning in formal educational institutions. The OECD PISA study furthermore finds that students improve their digital literacy through higher computer use at home, while no such learning effect was found for using the computer at school, indicating that education and training systems may need to reconsider how ICT is used for learning. (OECD, 2014)

Over the last few years, multiple initiatives have targeted the **content** of education and training programmes, particularly by focusing on science, technology, engineering and mathematics (STEM). By encouraging STEM studies, they want to supply the skilled workforce that is required to meet the increasing demand for bottleneck vacancies like ICT professionals, health professionals, science and engineering professionals and associate professionals (European Commission, 2014). This requires an investment strategy to be more responsive to labour market needs in terms of human capital and create a hospitable environment for enterprises, businesses and start-ups. In the context of STEM subjects, education partnership programmes and dual learning systems may improve the school to work transition.

In terms of **infrastructure**, innovative learning can be facilitated by the use of Connected Classrooms to exploit the potential of digitalisation for educational purposes. This requires substantial investments from schools, as they have to install and maintain ICT infrastructure and connectivity, including fast broadband and virtual learning environments (Wastiau et al., 2013). Strategic partnerships with other schools or private partners may facilitate these kinds of investments.

The digitalisation process also affects the educational tools and learning **methods** that can be used to improve the learning process. In this context, Titan and colleagues (2014: 271) refer to “e-learning, web-based educational material, distance study, online universities and programmes, and multinational educational consortiums”. Such learning methods make it possible to use a tailored approach when educating or training individuals with different profiles in the workforce (Dolphin T. (ed), 2015).

The European Commission promotes the practice of Open Educational Resources (OER) to guarantee the exchange of publicly financed educational materials. In that way, good practices are available to all and learning can happen at all times and all places. One particular practice that receives a lot of attention from both practitioners and policy makers are Massive Open Online Courses (MOOCs). They offer opportunities to anyone seeking to enhance their skills or acquire new ones through online courses and are characterised by a number of strengths and weaknesses (OECD, 2015).

An important strength is that MOOCs are offered at little to no cost. In this way, they can improve access to higher education across socio-economic groups and reduce inequalities. Due to the online nature of the courses, they also enable people from rural and isolated areas to enrol and participate in higher education. Moreover, MOOCs make the education sector more responsive to the labour market demands of employers since they can be organised by top universities as well as the business sector and independent experts. Another strength is that they introduce more flexibility in teaching and learning practices, thus facilitating participation of different segments of the population (e.g. part-time workers and elderly people), while promoting interaction between students, practitioners and educational institutions.

At the same time, a number of weaknesses need to be taken into account when assessing the potential of MOOCs. For instance, students need to have a computer with internet access in order to participate in a MOOC, meaning that students from disadvantaged backgrounds may be penalised. Moreover, students need to possess the skills to learn on their own and to find the time to follow the class. As a result, MOOCs may particularly reach the highly educated and motivated, especially since most MOOCs do not grant credits or degrees and, as result, qualifications/achievements may not be recognised in the labour market.

Finally, the European Commission's communication on ICT in education stipulates that learner-centred **pedagogy** using ICT and interdisciplinary research makes personalised and adaptive learning possible. In that respect, learning analytics tools support teachers' work by providing individual feedback and recommendations to students. Another example is serious educational games, which are powerful tools to engage students of all ages in learning. Fostering of online teachers' communities across Europe empowers them to use and co-create a wealth of educational repositories.

6. CASE STUDIES ON E-COMMERCE AND RELATED POSTAL SERVICES

KEY FINDINGS

E-Commerce has been growing at an annual rate of 22% in 2014 and is expected to keep on growing at a fast pace. This leads to the creation of new jobs directly via new types of labour requirements, and indirectly via an increase in productivity and demand. Ecommerce Europe estimated that the gross number of created jobs in the sector in Europe reached 2.5 million. The e-Commerce sector is a very competitive market with large fluctuations in activity. This could have an impact on working conditions, for example a growing share of part-time work or temporary jobs. Jobs in the e-Commerce are characterised by atypical hours, flexible contracts, on average lower wages and perceived quality of work, a high pressure on wages and working times and a high turnover. With the new jobs also come new skills requirements. Research highlights the growing importance of a combination of hard skills (e.g. programming) and soft skills (e.g. communication).

The impact of digitalisation on postal services is closely related with the growth of e-Commerce. The decline in demand for traditional mail and increased automation has had a negative impact on employment in the postal sector: the number of jobs in the sector declined from 1.19 million to 815,000 between 2004 and 2010 in the EU. However, these job losses are increasingly compensated by the growing parcel revenues due to e-Commerce and the diversification of activities.

6.1. Introduction

Having analysed the general impact of digitalisation on the labour market in chapter 5, in this chapter we will describe in detail two relevant sectors: e-Commerce and related postal services. As mentioned in previous chapters, these sectors are gaining importance with the digitalisation of the economy.

- **e-Commerce** can be defined as the use of the internet to conduct business transactions nationally or internationally (WTO, 1998). It is an important element of the Digital Single Market (DSM), providing increased choice and economies of scale. Cross-border e-Commerce allows citizens and business to enjoy a wider variety of goods and services and lower prices through increased price competition, which increases the GDP (lower prices increase purchasing power for other goods, increasing demand).

- **Postal delivery services** for documents and parcels provided by private companies or public undertakings continue to have a central role in the development of an effective and dynamic Single Market. However, the role of postal services is changing fundamentally. Demand for distribution of letters, newspapers, magazines, advertisements, and other documents is declining due to the rise of advanced

electronic communications. At the same time, demand for parcel delivery services is increasing due to the development of e-Commerce, just-in-time manufacturing, and other business trends driven by the new electronic technologies.

For both of these sector cases and when relevant, the job dynamics, working conditions, skills needed and possible policy issues are discussed below.

6.2. e-Commerce

6.2.1. Job dynamics

With an average annual growth rate of 22%, e-Commerce is one of the fastest growing sectors in the EU (statista.com, 2015). In 2014, e-Commerce was responsible for 7% of all retail sales. Forty per cent of these sales are made by internet retailers that exclusively operate online. Statista.com estimates that e-Commerce in Europe will continue to grow at a rate of 9.42% per year, which would lead to a market volume of 445,717.5 million USD by 2020. According to Dunne (2014), the completion of the Digital Single Market could lead to an additional 204 billion euro per year.

While the rapid growth of e-Commerce provides new opportunities, existing European firms are adapting at a rather slow pace. In 2014, the share of firms selling online was limited to 15% (European Commission, 2015). This is already an increase, compared to the 12% in 2009. Turnover from online sales follows a similar trend, but the increase in turnover is primarily realised by firms that were already participating in online sales.

The participation of firms in e-Commerce also varies significantly across countries. The proportion of enterprises selling online goods and services ranges from almost 30% in Denmark to about 5% in Italy (OECD, 2013). This variation corresponds closely with the position of countries in the Digital Economy and Society Index (DESI, 2015). A partial explanation for this is that the DESI also measures the integration of digital technology in firms and the use of internet by citizens. In this sense, it measures aspects that are clearly correlated with the success of e-Commerce. However, it also shows the relevance of other aspects such as infrastructure, human capital and digital public services in order to develop e-Commerce. A study of the OECD (2013) also shows the importance of the involvement of SMEs and, in particular, of small firms.

The impact of e-Commerce on employment will further grow and will cause both new jobs and job losses (Terzi, 2011). Examples of direct job creation are new labour requirements in entertainment, software, digital products and information-related goods and services. Indirectly, an increase in productivity and demand could result in new jobs. E-Commerce however could also form a substitute for traditional business models. Preliminary evidence shows that jobs in the retail sector, postal offices and travel agencies are most at risk. The impact of e-Commerce will not only vary over sectors, but also across countries, regions, industries or skill groups (ECLAC, 2002).

According to the e-Commerce association the gross number of jobs created, directly and indirectly, by the 'business to consumer' e-Commerce sector is estimated at nearly 2.5 million in Europe. They claim that "*this figure will undoubtedly grow with the on-going increase and penetration of the Internet in the European society, and the projected growth of (B2C) ecommerce"* (Ecommerce Europe, 2015).

6.2.2. Working conditions

The research on working conditions in e-Commerce is very limited. However, most of the general evolutions described in chapter 4 of this briefing note are also relevant for this sector.

Based on existing literature, focussing on the employment conditions in the e-Commerce sector, we can stress the following important employment characteristics of this sector;

- **Atypical hours:** Jobs in the e-Commerce are characterised by atypical working hours and flexible organisation of the work (parcels have often to be distributed when people are at home in the evening). Retail services traditionally serve as an entry point into the labour market, particularly for people seeking flexible hours and conditions.

- **Flexible contracts**: e-Commerce is characterised by a high labour intensity and great fluctuations in activity (e.g. peaks after the weekend and during Christmas, Easter etc.) Therefore, the sector often works with flexible contracts, e.g. temporary agency work, temporary contracts, part-time jobs. EurWork (2012) points out that large retailers increasingly rely on part-time shift work and temporary work in order to adjust their workforce according to customer needs. EurWork fears that this could lead to temporary and precarious forms of employment. Subcontracting is also often used in the sector.

- **On average lower wages and perceived quality of work:** Work in the retail sector is increasingly based on routinized jobs in e-Commerce logistics centres. This type of work generally consists of detailed and specific instructions. These standardised and routine forms of work generate job opportunities for labour market entrants and low-skilled workers. However, these employees have low wages and the quality of work is often perceived as low (EESC, 2015). Employees are not always able to fully develop their potential, which lowers job satisfaction.

- **Pressure on wages and working times:** A report by the ILO points to the changing working times and work organisation caused by the strong price competition in the retail sector (ILO, 2015). This puts a pressure on wages and working times of employees in a sector with already lower than average wages.

- **High turnover:** The ILO[4] considers that the e-Commerce is characterised by a high turnover. This high labour turnover can be explained in part by the seasonal nature of jobs in the e-Commerce, the large demand for temporary employment and the working conditions in the sector. A high turnover rate is often perceived as an indicator of low job satisfaction.

- **Other aspects of working conditions** specific for e-Commerce are more anecdotal. Large players in the sector have been heavily criticised for their

[4] During the Global Dialogue Forum of 21-22 September 2011 on the Needs of Workers in relation to Changing Work Processes and the Working Environment in Retail Commerce.

working conditions. In the documentary 'Merciless cheap- online shops on the rise' Amazon and Zalando are accused of exploiting workers offering poor working conditions in order to provide services such as free delivery and returns policies (e-commercefacts.com, 2012). Amazon also came into the firing line because of low wages and absence of collective agreements.

However, it is important to note that most of these characteristics are also common to the retail sector. There is no literature that compares the working conditions in the e-Commerce with the retail sector.

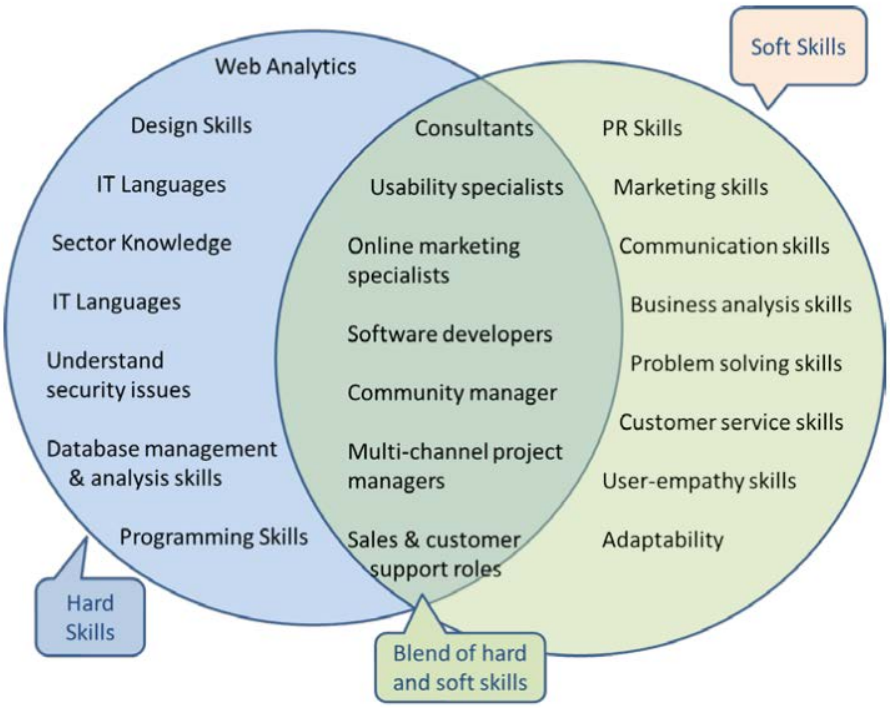
6.2.3. Specific skills needs

Limited research has been done on future e-business skills requirements for employees in the retail and wholesale industry. The demand for skilled experts in e-Commerce is still increasing. While more and more retail chains, particularly in clothing and fashion, have a growing demand for employees with a university degree, universities only provide limited relevant programmes (Klaiber, U., Hermanus, T., Mason, R.B. 2015).

As responsibilities and decision-making become more and more information based, ICT and e-Commerce demand new skillsets (Terzi, 2011). The demand for employees who are able to fully capture the large quantities of information on customer demands and production processes grows. Not only will the demand for high-skilled workers keep on increasing, but also the need for managers that are able to make decisions in very information-intensive situations and organisations (ECLAC, 2002).

The IFF Research report (2008) classified the requisite skills for e-Commerce into 'hard' and 'soft' skills as represented below:

Figure 5: Categorisation of skills required for e-Commerce



Source: IFF Research (2008)

The IFF Research report noted that the increased need to ensure a rapid implementation of new products and services in the retail sector has an impact on the skill requirements. Employees in this sector should not only be familiar with technological developments, but also up to date with overall online market trends, new products and changing customer demands. This requires technically trained IT specialists that are also in tune with the overall online business objectives. Because of the continued evolution of internet technologies, these skillsets need to be constantly updated.

6.3. Postal delivery services

6.3.1. Job dynamics

According to PostEurop, digitalisation has brought about a major transformation in the postal sector. However, digitalisation has had negative as well as positive impacts on employment in the sector.

Digitalisation has led to new forms of communication, which have changed our way of communicating and partially substituted physical letters. This development has had a negative impact on the letter mail volume and the revenues for the postal sector (Wik Consult, 2013). Combined with ongoing automation of sorting procedures and technological innovations that improved efficiency, employment in the postal sector has been under pressure. Employment in the postal sector in Member States declined from 1.19 million jobs in 2004 to 815,000 in 2010. Incumbent postal operators also had to re-organise in order to remain competitive. Delivery cost reduction in the last mile and outsourcing of postal activities were particularly damaging for employment in the postal sector (Wik Consult, 2013).

The main positive impact of digitalisation for the postal sector is the rapid growth of e-Commerce. This had led to an increase in parcel revenues and partially compensates for the decrease in letter mail delivery (Wik Consult, 2013). A recent study on the courier, express and parcel market in Germany showed that the total number of jobs has risen annually by about 2%, from 160,000 in 2002 up to 191,000 in 2012 (BIEK, 2013). A study by Hamilton (2011) indicates a similar increase in the European express market, with a growth from 240,000 jobs to 272,000 between 2003 and 2010. The author estimates that this growth will continue, with around 300,000 jobs by 2020.

Moreover, postal service providers diversified their activities into new markets such as logistics and the financial sector (Wik Consult, 2013). Some of them developed innovative products in these sectors and were able to increase the number of jobs. However, according to PostEurop, the diversification of activities does not always translate into the diversification of employment. It is also not always the same people and skills that are needed to perform these activities.

6.3.2. Working conditions

Working conditions in postal service providers are under pressure, partially because of the decrease in demand for their traditional services.

Moreover, as mentioned in the case study on e-Commerce, e-Commerce and the delivery of parcels, is a very competitive environment, with a lot of new operators due to the growing market. Atypical working hours and flexible organisation of work are also a characteristic of the sector (parcels often have to be distributed when people are at home in the evening). Finally, this sector is characterised by a high labour intensity and great fluctuations in activity (with peaks and downturns in activity in the week and during the year, e.g. peaks after the weekend and during Christmas, Easter etc.). Therefore, there is widespread use of subcontracting and temporary contracts. However, differences between Member States can be observed in these practices due to variations in regulations for subcontracting and temporary work between countries.

The impact of digitalisation on wages in the postal sector is unclear. Employees of public postal providers have lower average wages compared to the national average, but this could possibly be explained by the larger share of unskilled work (Wik Consult, 2013). The wages paid by postal services are also lower than in the transportation and storage sector, but the difference is relatively small.

6.3.3. Specific skills needs

The new skill requirements in the postal service are very similar to the skills needed in e-Commerce.

The main challenge for the postal services is to move from mail to parcel delivery. Both types of services use different machines and technology. Different training programmes are organised by the sector in order to re-skill their (ageing) workforce.

However, according to PostEurop, the main challenge in managing this move is not to acquire the skills, but to change how the work is organised. While mail delivery is considered to be a stable occupation (following the same route every morning for mail) parcel delivery needs more flexibility (delivery of different types of parcels to varying places and at different hours of the day).

7. EUROPEAN AND NATIONAL MEASURES

KEY FINDINGS

Several initiatives at European level support the evolution towards a digital economy and society. In order to fully exploit the business opportunities created by digitalisation, the European Commission invests in the Digital Economy, for instance by supporting digital entrepreneurship. Moreover, in its striving for smart, sustainable and inclusive growth, the primary focus of the Digital Agenda for Europe is on the development of a Digital Single Market.

These measures relate to the pillars of the OECD's Skills Strategy framework, namely developing skills, activating skills and using skills. At national level, they are complemented with a variety of measures relating to at least one of these pillars. However, Member States are at different stages of maturity and the level of e-skills policy activity fluctuates substantially across countries. This makes initiatives like the 'Grand Coalition for Digital Jobs' extremely valuable to reinforce best practice through actions with high local impact, especially since not only some of the best, but also some of the worst performing Member States have a 'national coalition' in place.

7.1. EU initiatives towards a digital economy and society

In order to exploit the potential of ongoing digitalisation, both Member States and European policy makers have taken measures to deal with a number of challenges and opportunities that come with increasing digitalisation. At European level, a number of complementary actions are taken in the search for (economic) growth.

On its portal site on the **Digital Economy**, the European Commission points out that digitalisation creates lots of opportunities that should be better exploited when striving for growth and employment in the EU. This is reflected in diverse policy measures taken in the field of entrepreneurship at European level.

- In the **Entrepreneurship 2020 Action Plan**, one pillar relates to "creating an environment where entrepreneurs can flourish and grow", thereby highlighting the potential of business opportunities in the digital economy.

- One of the ten principles of the '**Small Business Act for Europe'** (SBA) stresses the need to upgrade skills in SMEs as a response to a lack of skills related to new technologies, in order to maintain and improve their competitiveness.

Furthermore, one pillar of the Europe 2020 Strategy concerns the **Digital Agenda for Europe** seeking to fully exploit the potential of digital technologies in order to stimulate innovation and foster growth within the EU by 2020. The Digital Agenda comprises seven pillars:

1. Achieving the Digital Single Market

2. Enhancing interoperability and standards
3. Strengthening online trust and security
4. Promoting fast and ultra-fast internet access for all
5. Investing in research and innovation
6. Promoting digital literacy, skills and inclusion
7. ICT-enabled benefits for EU society

In its striving for smart, sustainable and inclusive growth, the primary focus of the Digital Agenda is on the development of a **Digital Single Market (DSM)**. The European Commission has put the realisation of the DSM high on its agenda. More specifically, in May 2015, it adopted the DSM strategy, which is built on three pillars defined as follows:

- **Access**: better access for consumers and businesses to digital goods and services across Europe. This requires the rapid removal of key differences between the online and offline worlds to break down barriers to cross-border online activity.
- **Environment**: creating the right conditions and a level playing field for digital networks and innovative services to flourish. This requires high-speed, secure and trustworthy infrastructures and content services, supported by the right regulatory conditions for innovation, investment, fair competition and a level playing field.
- **Economy & Society**: maximising the growth potential of the digital economy. This requires investment in ICT infrastructures and technologies such as Cloud computing and Big Data, and research and innovation to boost industrial competiveness as well as better public services, inclusiveness and skills.

The Digital Agenda Scoreboard measures progress of the European digital economy by means of the Digital Economy and Society Index (DESI), which has been discussed in Chapter 2 of this briefing note. Its five dimensions reflect today's policy priorities on the topic of digitalisation, namely connectivity, human capital, use of the internet, integration of digital technology and digital public services.

Monitoring data of the Digital Agenda Scoreboard show that the European Union is progressing, especially in the fields of Connectivity and Human Capital. However, EU citizens should be able to use the Internet to a larger extent, whereas companies and industries should increase the Integration of Digital Technology. Even though the basic digital skills of EU citizens have improved, they still lack essential skills and competencies to exploit the potential of the digital economy as much as possible.

7.2. Need for a multifaceted approach to support employment in the digitalising labour market

The Digital Agenda Scoreboard points out that multiple factors need to be of high quality in order to exploit the potential from increasing digitalisation: while the right infrastructure has to be in place, people need to have the skills to operate it and also require the skills to function well in the labour market and society. According to the **OECD Skills Strategy**

framework that provides a strategic approach to boost employment and growth while promoting inclusion and participation, both economic prosperity and social cohesion can be fostered by strengthening skills systems on three dimensions, which are described in detail on the portal site 'skills.oecd.org':

- **Developing relevant skills** by 1) encouraging and enabling people to acquire the right skills throughout life, 2) fostering international mobility of skilled people to fill skills gaps, and 3) promoting cross-border skills policies.

- **Activating skills supply** by 1) encouraging people to offer their skills to the labour market and 2) retaining skilled people in the labour market.

- **Putting skills to effective use** by 1) creating a better match between people's skills and the requirements of their job and 2) increasing the demand for high-level skills.

Previous research identified numerous policy measures that contribute to at least one of these dimensions. Recent studies on e-skills published by the European Commission (McLaughlin et al., 2014 and Gareis et al., 2014) and the OECD (2011), map out the diverse programmes that are in place throughout Europe. They show that across the EU-28 today there are some 100+ policies dealing broadly with e-skills. However, the European e-skills landscape is extremely diverse and complex given that Member States are at different stages of ICT maturity and varying issues are considered of national importance. This results in a level of e-skills policy activity that fluctuates substantially across the various Member States, and a plethora of policies addressing a wide range of policy areas.

In the remainder of this chapter, we cluster the measures analysed in depth in the studies mentioned above. In doing so, it becomes clear which fields a lot of activity is going on in and where additional measures could be taken, at national or EU level.

7.2.1. Developing relevant skills

Adjusting educational systems

In all Member States, policies focusing on education mainly aim at **adapting school curricula and ICT infrastructure** at all educational levels to the needs imposed by the rapid pace of digitalisation. OECD research (2011) concludes that e-skills are especially promoted in higher education and to a lesser extent in vocational and on-the-job training. They receive the least attention in primary and secondary education. On the whole, four fields of actions are identified:

- In order to **embed ICT use and media literacy** within the entire learning process, a number of Member States have revised their curricula. In doing so, they sought to promote topics related to diverse aspects of technology from an early age. The extent of the reforms varies from country to country, ranging from the inclusion of (basic) ICT skills into education in general (e.g. Austria, Estonia and Sweden), to the inclusion of programming/coding and computational thinking as a generic stand-alone subject (e.g. Denmark and the U.K.).

- When changing curricula and developing courses, institutions may be encouraged to **consult the industry and respond to their needs**. Examples can be found in

Norway and Portugal where public funding is available for higher education institutions that make an effort to attract more students towards programmes associated with STEM.

- Other policies develop **teacher training curricula** in order to develop the skills for using ICT as a teaching and learning tool. Some EU Member States (e.g. Finland and Ireland) have begun providing teachers with tools for ICT training in order to maximise benefits from investments in ICT in the classroom.

- Some governments have started to promote the **deployment of ICT and broadband in classrooms**. In many cases investments in institutions' infrastructure are made in all types of education institutions. This may increase the deployment of e-learning applications, for instance, to offer individuals other learning methods and to provide them with better resources to learn "on-the-job" and "just-in-time" in vocational education and training (VET).

Policies targeting specific groups

Several training programmes target particular groups such as ICT professionals, people lacking basic e-skills, women, the unemployed, and young and elderly people.

- EU Member States like Germany, Spain and Sweden have initiated policies to encourage a positive **gender balance** within Europe's ICT profession. These policies are primarily aimed at promoting ICT-related studies and career paths for girls and women from an early age.

- Germany also has programmes in place targeting young people **and older workers**.

- Many governments (like the Dutch and the Swedish governments) seek to stimulate more people, and especially the **unemployed**, to enrol in ICT-related studies. To this end, programmes that are already in place, are being improved.

- Some countries have implemented policies targeting **migrant workers**, but their entrance into the labour market frequently depends on particular conditions that are usually linked with their capability to fill in bottleneck vacancies. For example, Danish policy makers introduced a number of programmes to facilitate the process of getting a work permit for high-skilled workers including ICT professionals. Such arrangements are for put in place for migrant workers that come to Denmark to be employed in one of the professions included in the "Positive List", i.e. a list of bottleneck occupations for which Danish employers need more qualified workers. Accordingly, Austria, Estonia and France have established policies aimed at reforming their national immigration policies.

Engage partners in education and training

In more and more countries, **multi-stakeholder partnerships (MSPs)** have been introduced in recent years, based on the reasoning that the private sector has additional resources at its disposal to complement public services, particularly in the education and training sector. Ideally every stakeholder that is closely associated with a particular topic related to e-skills at the national level is involved to guarantee that evolutions are sufficiently supported, comprehensive and self-sustainable.

In this respect, the U.K. is often put forward as an example of good practice. More specifically, the Tech Partnership[5] continues the work of 'e-skills U.K.'. It is a growing network of companies that join forces to provide the skills that are necessary to generate growth in the digital economy. The British government recognises the Tech Partnership as the 'Industrial Partnership for the Information Economy'. The main objective is to encourage young people, and especially girls, to engage with technology education and pursue careers in related fields, to create new jobs, to develop new skills and to set industry standards (and to accredit and promote education and training that meets these standards).

7.2.2. Activating skills supply

Active labour market policies rarely focus exclusively on digital employment. However, some measures may help to support people with the right skills and retain them in jobs where they use those skills.

- The ICT profession is suffering from poor public image in a number of Member States. By focusing on **awareness raising,** some policy programmes (e.g. in France and Germany) seek to counter stereotypes about ICT workers, their career prospects, etc. and give the ICT sector and careers in ICT more visibility and a more positive, and realistic, image. Besides targeting the general public, they typically target students and those who safeguard students' development of e-skills and they promote careers in STEM-related fields. In this respect, people may be encouraged through financial and fiscal incentives to enrol in educational programmes in order to obtain skills that are lacking in the labour market. Apart from targeting individuals, some programmes target SMEs to increase their awareness about the impact of e-skills on their competitiveness.

- Some countries in Europe (like the Netherlands) have realised that there is a need to **up-skill and re-skill their experienced ICT professionals** to reduce the outflow of these individuals from the sector. These efforts are aimed at retaining them in the sector and enabling them to specialise further.

7.2.3. Putting skills to effective use

In order to put people's skills to effective use and efficiently match demand and supply in the digitalising labour market, accurate **labour market information** is increasingly important.

- In order to **monitor** the dynamics of the labour market, most Member States turn to ad-hoc commissioned research. However, a few advanced Member States (like Germany and the U.K.) have comprehensive market monitoring systems in place. Many governments have internet based portals at their disposal for job seekers so employers can post vacancies. In some countries observed shortages in specific occupations and skills are listed and used when designing migration policies. The EURES portal of the European Commission, for example, contains data, guidance and job matching services for job seekers and recruiters in terms of occupation, country

[5] https://www.thetechpartnership.com/

or seniority. Furthermore, at EU-level, the New Skills for New Jobs initiative stresses the need for an accurate estimation of future skills needs. It focuses on improving matching between supply and demand in the labour market. An important practical measure to this end are the forecasts by the European Centre for the Development of Vocational Training (CEDEFOP) and the University-Business forum, which enables direct contact between educational and training institutions and the business community.

- Despite these efforts, the mismatch between the demand and supply of ICT jobs is a persistent problem across Europe, as indicated by the high number of unfilled vacancies in the ICT sector. Recent initiatives have been developed in different countries to raise awareness about ICT professional competences and to support the implementation of ICT professional **competence frameworks** as a means to match jobs and ICT professional competences. The development of the European e-Competence Framework (e-CF), which is considered to be the common language for describing e-competences in Europe boosted the development of commonly accepted e-skills frameworks in Member States.

- As awareness of skills mismatches has increased; in some Member States (e.g. Belgium and Ireland) new policies have emerged that aim to **better match training/educational curricula to labour market demand**. These policies place partnerships with industry at their core. Furthermore, the international project CompeTIC between the Belgian Walloon Region and the French Region North-Pas-de-Calais illustrates how job mobility across borders may improve the matching process.

- Boosting **entrepreneurial activity** may also increase the demand for high-level skills and so put skills to effective use. In order to remain competitive, policy programmes need to address e-leadership besides digital literacy and e-skills for practitioners, which are far more at the centre of political activity. Digital entrepreneurs need e-leadership skills to keep reinventing themselves, their products and their services in the context of the digital economy. The European Commission draws attention to new business opportunities, for instance by supporting digital entrepreneurship through the Strategic Policy Forum and Member States Board on Digital Entrepreneurship. Apart from the strategic approach provided by these institutions, awareness campaigns are in place to promote digital entrepreneurship. Examples mentioned on the Commission's portal on the Digital Economy are Watify, Euromentors Association and the Digital Entrepreneurship Monitor.

7.3. Grand coalitions to reinforce best practice

Member States tend to use a combination of the measures discussed above to develop e-skills and fill ICT-related bottleneck vacancies in the economy. Pursuing the same goal at EU level, the European Commission has introduced the 'Grand Coalition for Digital Jobs', which is a large-scale partnership involving multiple stakeholders from the public and private sector, such as companies, NGOs and actors in the fields of education and training. The main objective is fourfold[6]:

[6] http://ec.europa.eu/digital-agenda/en/grand-coalition-digital-jobs-0

- Offering more ICT-training in collaboration with the industry;
- Implementing job placement programmes;
- Providing more digitally aligned degrees and curricula at all levels and types of training and education;
- Motivating young people to study ICT and pursue related careers.

In these fields the Grand Coalition introduces initiatives starting with existing programmes and successful measures seeking to further develop them. One example is the campaign 'eSkills for Jobs' to raise awareness of the importance of e-skills.

There are two ways for stakeholders to get involved: by making pledges or starting (or joining) a national coalition. Either way, they have the opportunity to design and implement actions with large local impacts. From a practical point of view, stakeholders have a toolkit at their disposal to support them in setting up national partnerships and design actions to improve job matching and reduce the skills gap in the digital economy. Yet, from a financial perspective, no specific budget is related to the activities of the Grand Coalition. Nonetheless, both at national and European level, funding is available for actions seeking to develop e-skills.

The coalition was launched in March 2013. By October 2015 over 80 stakeholders had joined the Grand Coalition by making pledges (official commitments) to pursue the goals mentioned above and 13 countries had a 'National Coalition for Digital Jobs' in place (BE, BG, CY, EL, IT, LT, LV, MT, NL, PL, PT, RO, UK).

8. POLICY RECOMMENDATIONS AND OPEN QUESTIONS FOR FUTURE RESEARCH

8.1. Main conclusions and results

Digitalisation has had and still has a substantial impact on the labour market, by modifying job dynamics, working conditions and skills needed. The transformations induced by digitalisation constitute both opportunities and risks alike.

However, each Member State will not be affected in the same way, as there are uneven developments and integration of digitalisation across the European Union. The highest performing countries (Scandinavian countries and the Netherlands) are considered as world leaders in digital competitiveness. Conversely, some new EU Member States (the Czech Republic, Latvia, Slovenia, Hungary, Slovakia, Cyprus, Poland, Croatia, Bulgaria and Romania) and South European Countries (Italy and Greece) are lagging behind and need to catch up with other Member States.

This **digital divide** should be taken into account when analysing the impact of digitalisation on the European labour market.

Based on the findings, we can first conclude that the following **job dynamics** are induced by digitalisation:

- On the one hand, digitalisation generates **new business models and new jobs**, by creating **new products** (e.g. the app technology), **new machines** (3-D printing) and reducing the **cost of production**. However, not every sector of the economy gains from digitalisation. This depends on the interaction of the production costs, organisation and potential market reach of each sector. Digitalisation is estimated to create jobs in the hospitality and retail sectors because of the enhanced reach but the number of jobs will be reduced in the financial and the manufacturing sectors because the productivity gains surpassed the output gains.

- On the other hand, digitalisation also encourages the **outsourcing of jobs** or parts of jobs to countries with low labour costs. Estimates showed that only a very limited proportion of ICT jobs are at risk of being outsourced (only 1.5% of the total predicted demand for ICT skills in 2020). However, due to automatisation, some jobs may even disappear completely. Estimates by the think tank Bruegel indicate that 40 to 60% of jobs in EU Member States are at risk due to digitalisation-induced automation. The jobs most at risk are considered to be medium-skilled jobs (office and administrative support work; sales and services; transportation; construction and extraction; production (manufacturing)).

- While it is clear that some sectors will gain and others will lose, the net impact remains ambiguous. Debates about the impact of digitalisation on the number of jobs is divided between the **minimalists** (who believe little will change) and the **maximalists** (who believe that everything will). However, according to Cedefop's (2010) latest forecast of the skills demand and supply in Europe, the **net impact will be positive**. Cedefop forecasts around seven million extra jobs by 2020. Digitalisation is one of the key factors explaining the creation of these

new jobs. Most new jobs, will be in knowledge- and skill-intensive occupations, such as high level managerial and technical jobs, but also low-skilled jobs, such as elementary occupations. A lot of medium-skilled jobs, such as manual and routine jobs, will disappear. One of the main challenges is to provide these new jobs with the right supply of skills. According to the Commission, the skills shortage might cause up to 900,000 unfilled vacancies between now and 2020, the bulk of which will be in ICT and related services, due to a "skills mismatch" (EESC, 2015).

Secondly, digitalisation also induces **major transformations in how work is organised** and **employment relationships**. This prompts evolutions at a micro-economic level (at the level of companies and individuals) but also at a macro-economic level (at the level of the labour market and society).

- At a micro-economic level, workers have the flexibility to **work anytime and anywhere**. This could help workers in improving their work-life balance but could also have positive consequences on the employment of people seeking more flexible work arrangements (e.g. women, older workers) but also less mobile people.

- Digitalisation and the time- and place-independent work also induces **new ways of working flexibly and new types of employment relationships**, such as:

    - Telecommuting or telework
    - Freelance work or independent professional (iPro)
    - Crowdsourcing
    - Employment in the shared economy

- However, there are still **no clear definitions** of these new ways of working, which makes it difficult to collect data and monitor these phenomena. Some data are available and show a clear increase in these practices.

- Anytime and anyplace working offers opportunities to develop worker-friendly forms of flexibility but also has some **negative side effects**. For example, increased work intensification and the obligation for workers to always be available may cause stress and burn-out. Moreover, there are also concerns about access to social protections for workers under these flexible work arrangements.

- At a macro-economic level, digitalisation is leading to the gradual **polarisation of employment** in terms of work autonomy and wages, creating increased inequalities. Jobs are more likely to be situated at either the high or the low end of the wage and autonomy distribution, with a declining number of jobs between the extreme poles.

- Finally, all the evolutions in the working conditions at a micro-economic level also pose major challenges for the **social security models** of EU countries. The social security models of most EU countries were developed in a period when

male, full-time and fixed-term contracts were the dominant feature. Due to digitalisation, new flexible employment relationships are emerging and are resulting in atypical career patterns (e.g. freelance work). Policymakers will therefore face a significant challenge to bring their social protection mechanisms into line with the new flexible employment relationships and ensure social protection to all types of workers.

Thirdly, digitalisation induces major evolutions in the skills needed:

- Digital technologies are being introduced to a growing number of workplaces in the services sectors. As a consequence, workers will increasingly need to have both generic and specialised e-skills to accomplish their tasks at work and capture potential productivity gains. Even if ICT skills are becoming an important requirement for employment across the economy, a **significant part of the population lacks the basic skills** necessary to function in this new environment. Certain demographic groups are less prepared for the rapidly changing employment environment because they have limited e-skills (older and low-skilled workers). However, labour market disruptions will hit some workers harder than others and often these people will be precisely the people with the lowest levels of ICT skills and who are least prepared to update their skills.

- Both employed and unemployed job seekers require more and more e-skills for gathering information on job vacancies and applying for jobs. **Job matching and recruitment process** increasingly make use of digital methods (e.g. social media, applicant tracking systems, mobile recruiting, jobs boards and career pages). This evolution may also constitute an important barrier for older job seekers and low-skilled unemployed people with limited e-skills. Additionally, since applicants are increasingly requested to have mobile access, people with limited access to computers or smart phones are in a less favourable situation.

- Digitalisation also introduces new requirements for **generic skills**. Individuals need to be able to work across different disciplines, to collaborate virtually, to demonstrate social and cultural sensitivity, to filter information and to keep up with the new skills that the new technologies will demand. Generic and soft skills are also becoming increasingly important, sometimes surpassing even the need for pure technical skills thereby implying that employers ask for relatively high levels of experience and education.

- The new skills needed require **reforms in initial vocational education and lifelong learning** in order to deliver more general and specific digital capabilities but also new models of learning. The rapidly changing nature of advanced ICT makes **workplace training**, in addition to formal education, increasingly important for adapting workers' skills. Encouraging **STEM studies** is also essential in order to fulfil the increasing bottleneck vacancies such as for ICT, health, and science and engineering professionals. Moreover, digital technology will also challenge traditional **methods of delivering education and training**. E-learning, web-based educational material, distance study, online universities and programmes are a way to offer flexible learning pathways to students and workers.

Finally, we observed that in order to exploit the potential of the ongoing digitalisation, both Member States and European policy makers have taken **measures** to deal with a number of challenges and opportunities that come with the increasing digitalisation.

Across the EU-28 today there are some 100+ policies dealing broadly with e-skills. Most are linked to the following dimensions: developing relevant skills, activating skills supply and putting skills to effective use.

However, the European e-skills landscape is extremely diverse and complex given that Member States are at different stages of ICT maturity and varying issues are considered of national importance. This results in a level of e-skills policy activity that fluctuates substantially across the various Member States, and a plethora of policies addressing a wide range of policy areas.

8.2. Policy recommendations

Based on the main results and conclusions, the following policy recommendations could be stressed:

- Policy makers should be aware that low to medium incomes are most at risk when it comes to job losses caused by digitalisation. Therefore, shifts in demand for labour stimulated by digitalisation should be **monitored closely** and **measures to support and guide these workers** during transitions should be offered. This will require further improvement of job guidance and training programmes in order for Member states to respond to the new needs of the labour market.

- To avoid the digital divide and increased inequality between EU Member States, **reforms in initial vocational education and lifelong learning** should be closely monitored and implemented in each Member State.

- There is a need for a **common definition of the different new types of work** (teleworking, freelance working, crowdsourcing) in order to closely monitor these phenomena and their impact on the labour market statistics.

- The new forms of work, like teleworking, freelance work and crowdsourcing confront companies and governments with **new questions about social protection, and health and safety issues**. The legal framework of these different types of work should be examined to determine whether it needs to be updated in specific areas in order to maintain workers' protection and to adequately cover new forms of work as well.

- Policymakers should also bring their **social protection mechanisms** into line with the new flexible employment relationships and ensure social protection to all types of workers.

- To protect workers' private lives and prevent mental health issues, European framework legislation should establish the **right of employees** to clearly define working and leisure time and to switch off mobile communication devices outside of work hours.

8.3. Questions for future research

Finally, based on the main results and conclusions, it is also possible to identify questions for further research:

- The **net effect of digitalisation** for jobs in Europe is not yet known and would need further research. While it is clear that some sectors will gain and others will lose, the net impact remains ambiguous.

- Anytime and anyplace working offers opportunities to develop worker-friendly forms of flexibility but also has some **negative side effects**. However, the possible negative side effects caused by the new ways of working are not yet clear and should be further analysed.

- There is a need **to collect and monitor data** on these new types of jobs in order to identify their impact on labour market statistics.

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