LABOUR JOB DIGITALIZATION: MYTHS AND REALITIES

Eleftheria KOLOKYTHA[1], Georgios KOLOKYTHAS[2], Fotini PERDIKI[3], Stavros VALSAMIDIS[4]

[1]TEI of East Macedonia and Thrace Kavala Greece, Ele_kol@hotmail.com
[2]Manpower Employment Organisation, Athens Greece, geokol@gmail.com
[3]TEI of East Macedonia and Thrace, Kavala Greece, fperdiki@teikav.edu.gr
[4]TEI of East Macedonia and Thrace, Kavala Greece, svalsam@teikav.edu.gr

Abstract: Nowadays, there has been a wide discussion and also concerns about the fact that automation and digitalization might result in a serious job loss. On the other hand, in many European countries, there is a serious problem of shortage of labour supply. That means, digitalization can be actually a solution to the problems in labour market rather than a social and economic problem. Researchers are sceptical about "job polarisation", where middle-skill jobs are declining but both low-skill and high-skill jobs are expanding. Digitalization will not only cause mass unemployment, but it will speed up the existing trend of computer-related automation, disrupting labour markets just as technological change has done before, and will require workers to learn new skills more quickly than in the past. This study analyses the digitalization processes in European countries, in order to cover the problem of labour deficit. In order to detect the possible solutions to labour deficit, we use two particular indices, ICT Specialist Skills and DESI, and correlate their values with the corresponding values of employment rates in specific European countries for the last 5 years. The outcomes may support the views for: (a) structural problems of labour market in Europe, (b) the digitalization impact on employment and substitution of jobs, and (c) a cross-country comparison on how digitalization processes are used and help to solve the labour deficit problem in selected European countries.

Keywords: Digitalization, employment, ICT Skills, DESI correlation, European countries.

JEL Classification Codes: J21, L86.

1. INTRODUCTION

In recent years, there has been a wide discussion and also concerns that automation and digitalization might result in serious job loss. This debate has been particularly fuelled by Frey and Osborne (2013), who argue that 47% of jobs in the US are at risk of computerization. On the other hand, in many European countries there is a serious problem of shortage of labour supply. That means, digitalization can be actually a solution to the problems in labour market rather than a social and economic problem (Beck, 2018).

The first industrial revolution was initiated in Europe, and more specifically in the United Kingdom, but the introduction of the automated production line in Ford Industries signified the beginning of a new era. In fact, as Handel (2005) describes, this inspired the generation of two kinds of theories on the working models: the new-Fordist and the post-Fordist theories.

According to the new-Fordist theory the employers taking advantage from the induction of automations pressed their employees to produce more without any raises on wages or other types of rewards. In such a system, there is a huge question rising on how long this situation can be viable. Whereas, post-Fordist theory believes in a more just system, which utilizes effectively the available resources while adopting a more fair rewarding method, that even covers the proper adjustment of the wage level. In this way, the employees feel more satisfied and are willing to contribute for the achievement of the target goals.

In an effort to depict the level of computerization, Frey and Osborne (2017) designed a model that would end up with the probability of computerization for a list of occupations. They have identified the fact that technology was more than able to cope with tasks requiring repetitive movements in a form of pattern. As a result, the routine tasks were continuously computerized pushing aside the human workers.

Later on, Berger and Frey (2016) called this phenomenon job polarization, which simultaneously generated working positions requiring high level of digital skills, while limiting the positions demanding low level skills. Researchers are already skeptical about job polarisation, where middle-skill jobs are declining but both low-skill and high-skill jobs are expanding (Goos et al., 2014; Michaels et al., 2014). In effect, the workforce bifurcates into two groups doing non-routine work: on the one hand highly paid, skilled workers and on the other low-paid, unskilled workers (David & Dorn, 2013).

Hollowing-out is another term used to describe job polarisation; it is the process by which the shares of total employment in high-ranked and low-ranked jobs have expanded relative to middle-ranked jobs over time, where jobs are ranked by their initial wage (McIntosh, 2013). Thus, more high-level jobs are created, such as professional and managerial positions, but there is also a growth in the relative share of low-level, typically personal service jobs. These increases in employment shares have come at the expense of mid-level jobs (Frey & Osborne, 2017).

We are today at the beginning of a Fourth Industrial Revolution (Schwab, 2016). Developments in previously disjointed fields such as artificial intelligence and machine learning, robotics, nanotechnology, 3D printing and genetics and biotechnology are all building on and amplifying one another. Smart systems such as homes, factories, farms, grids or entire cities will help tackle problems ranging from supply chain management to climate change. Concurrent to this technological revolution are a set of broader socio-economic, geopolitical and demographic developments, with nearly equivalent impact to the technological factors (Castells, 2011).

This study investigates the digitalization processes, the ICT skills and the employment rates in European countries in order to cover the problem of labour deficit. In order to detect the possible solutions to labour deficit, we use two particular indices, ICT Specialist Skills and Digital Economy and Society Index, and correlate their values with the corresponding values of employment rates in specific European countries for the last years. The outcomes may support the views for (a) structural problems of labour market in Europe, (b) the digitalization impact on employment and substitution of jobs and (c) a cross-country comparison on how digitalization processes are used and help to solve labour deficit problem in selected European countries.

2. LITERATURE REVIEW

The evidence of job polarisation in favour of high-skilled and low-skilled jobs is inconsistent with the hypothesis of skill-biased technological change (Autor et al. 2003; Goos & Manning, 2007; Jung & Mercenier, 2014). These papers suggest that employment growth has taken place in low-paid personal service jobs and in well-paid professional and managerial jobs, while employment in average-paid production and office jobs has disappeared (Oesch & Menés,

2011). Job polarization has been documented by David et al. (2006) and David & Dorn (2013) for the US, and Goos & Manning (2007) for the UK. Job polarization has also been documented for Germany (Spitz-Oener, 2006; Dustmann et al., 2009) and there are indications that it is pervasive in European countries (Goos et al., 2014; Michaels et al., 2014).

The labour markets around Europe have undergone important changes, manifesting themselves through dynamic processes such as job creation and destruction, skill upgrading, unemployment and wage inequality. The underlining force driving these symptoms is the fact that the structure of employment is constantly changing, and new jobs and skills are frequently arising (Goos et al., 2014).

In their work, Gallie et al. (2004) discuss the polarisation of skills. Skill polarisation may occur at the occupation level, where workers in lower occupational classes face skill stagnation or depreciation, the opposite holds for a worker in higher occupational classes because their employers tend to invest in on-the-job training. Skill polarisation could also arise on the basis of contractual status, in a core-periphery setting. At the core, we find full-time permanent workers, who are offered skill training; at the periphery we find part-time and temporary workers.

Job polarisation has received attention from academics and policy-makers. Many studies have been conducted on the causes and consequences of the phenomenon. Among the possible causes of job polarisation are technological change and globalisation, both of which mainly impact routine jobs (Blinder, 2009). Importantly, jobs, particularly in the middle of the distribution, are affected (Beblavý et al., 2012). The demand for high-skilled employment has been on the rise for many years, and a similar trend is detected for low-skilled jobs (especially in the service sector) (Maxwell, 2006). Low-skilled service jobs, however, commonly offer minimal levels of job quality and job security, low wages and few possibilities for advancement. These jobs, therefore, tend to come attached with negative selection stigma and are difficult to fill (as many of the unemployed try to avoid such positions, particularly if before they held low-skilled manufacturing jobs that offered a higher wage) (Lindsay & McQuaid, 2004). Furthermore, while low-skilled service jobs are sometimes referred to as de-skilled due to the very low barrier to entry; in many cases, they tend to be quite demanding in terms of social and language skills and – in some cases – even in terms of formal education.

The rapid change caused by digitalisation requires businesses to adapt their business model. In many cases, this also translates into changing skill requirements. Digital skills are defined at different levels, ranging from digital literacy to technical skills like big data analytics and app development (Spitzer et al., 2013). Specific technical skills in need of development in Silicon Valley are skills related to application development and web development, scriptwriting and virtualisation. Furthermore, cloud experience becomes more and more important and technical skills. While these advanced technical skills are important for improving one's job prospects (McKinsey & Company, 2015), all individuals need to be able to find, process, use and create digital content to function well in the labour market and in society as a whole (as consumers and citizens). Hence, digital literacy is on the agenda of policy makers all over the world. For a more detailed description of the spectrum of digital skills, we refer to our briefing note on the impact of digitalisation on the European labour market (Valsamis et al., 2015).

These skills need to be accompanied by cognitive and generic skills, such as creativity and communication skills, to create value (OECD, 2015). This reasoning is in line with the discourse on 'double deep skills'. David Moschella, the Research Director for CSC's leading edge forum, defines these as the combination of job-specific skills and skills related to relevant technologies that are necessary to do that job in the current digitising economy (Valsamis et al., 2016).

In other words, today's workers need hybrid skills set of professional and IT skills to be employable and in strong demand in the US labour market. In any profession people need to be aware of the impact of technology and be able to use it to their advantage as their jobs become increasingly driven by and dependent on technology.

In terms of the evolution of required skills levels, job dynamics described below imply that medium-skilled routine jobs (like bookkeeping) are in decline (De Stefano, 2015), while there is an 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) (David & Dorn, 2013). Hence, medium-skilled workers will need to upgrade their skills to be employable and to qualify for higher-skilled jobs. However, besides older workers and people with lower than upper secondary education they are one of the groups who most lack digital skills. Brynjolfsson & McAfee (2014) offer an unsettling picture of the likely effects of automation on employment in their book The Second Machine Age, MIT scholars.

Clearly, the past two centuries of automation and technological progress have not made human labour obsolete: the employment-to-population ratio rose during the 20th century even as women moved from home to market; and although the unemployment rate fluctuates cyclically, there is no apparent long-run increase. But those concerned about automation and employment are quick to point out that past interactions between automation and employment cannot settle arguments about how these elements might interact in the future. In particular, the emergence of greatly improved computing power, artificial intelligence, and robotics raises the possibility of replacing labour on a scale not previously observed. There is no fundamental economic law that guarantees every adult will be able to earn a living solely on the basis of sound mind and good character. Whatever the future holds, the present clearly offers a resurgence of automation anxiety (Akst, 2013).

Changes in technology do alter the types of jobs available and what those jobs pay. In the last few decades, one noticeable change has been "polarization" of the labour market, in which wage gains went disproportionately to those at the top and at the bottom of the income and skill distribution, not to those in the middle. However, David argues that this polarization is unlikely to continue very far into the foreseeable future (2015).

Because jobs that are intensive in either abstract or manual tasks are generally found at opposite ends of the occupational skill spectrum—in professional, managerial, and technical occupations on the one hand, and in service and labourer occupations on the other—this reasoning implies that computerization of "routine" job tasks may lead to the simultaneous growth of high-education, high-wage jobs at one end and low-education, low-wage jobs at the other end, both at the expense of middle-wage, middle education jobs—a phenomenon that Goos & Manning (2014) called "job polarization". A large body of US and international evidence confirms the presence of employment polarization at the level of industries, localities, and national labor markets (David et al., 2006; Goos & Manning 2007; David & Dorn, 2013; Michaels et al., 2014; Goos et al., 2014; Graetz & Michaels, 2015).

3. BACKGROUND THEORY

Technological change and globalization appear to be the two main economic forces behind job polarization. The computer revolution that took hold in the early 1980s and accelerated through the 1990s dramatically changed how people work (Castells, 2011). The widespread diffusion of technology in the economy created employment opportunities for many highly skilled workers— particularly for those who create technology, such as engineers and software developers, and for those who use it in their jobs, such as managers, financial analysts, and

scientists (Brynjolfsson & McAfee, 2014). At the same time, workers performing routine tasks have been increasingly displaced by technology. By contrast, many low-skill workers, such as waiters, hairdressers, and health care aides, have been largely insulated from such displacement because personal contact is still required to perform the job (Frey & Osborne, 2017).

A second key factor shaping job polarization is globalization, which has created opportunities for some workers but displaced others (Beck, 2018). Again, routine middle-skill jobs, especially in manufacturing, are particularly subject to this type of labour competition. Indeed, the availability of inexpensive labour overseas is a key factor underlying the decline in manufacturing jobs over the past three decades. By contrast, workers in jobs that require physical interaction and personal contact have been largely shielded from globalization since these jobs cannot be easily performed at a distance (David, 2015). For example, face-to-face contact is an important component of the job for teachers, police officers, entertainers, and nurses, while physical proximity is important for jobs that must be done on-site, such as construction, equipment repair, and building maintenance (Frey & Osborne, 2017).

Along with technology and globalization, changes in the demand for goods and services have shaped job polarization. As countries like the United States grow richer, growth in the consumption of services tends to outpace growth in the consumption of goods (David & Dorn, 2013). Employment in the goods-producing sector is disproportionately composed of middle-skill workers, while service sector workers are concentrated at the top and bottom of the skill distribution. The polarisation of labour is a phenomenon where the demand for labour does not rise linearly with the skill level but rather resembles a U-shaped function as depicted on Figure 1 (Maselli, 2012).
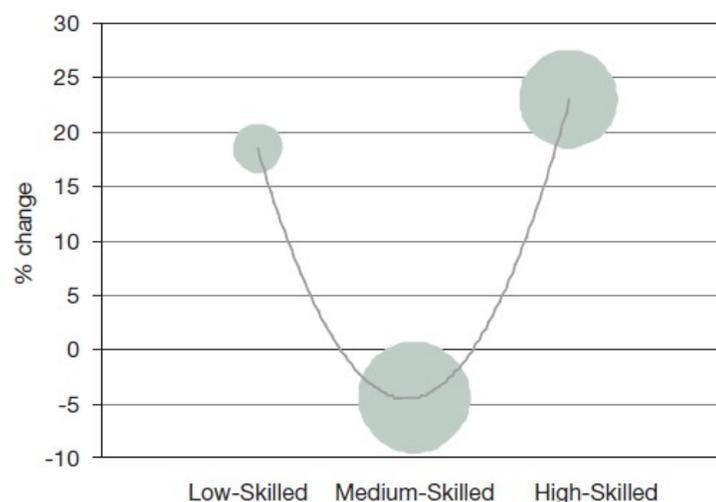
Figure 1: Changes in demand for jobs per skill level (Source: Maselli, 2012)

ICT Specialist Skills is a very generic term which includes also other professions related to the ICT Sector, like ICT Programmers, who develop programs and applications, ICT Users, who utilize the programs so as to produce data, Data Analysts, who effectively analyze the produced data in order to offer possible solutions and ICT Service Managers, who should be able to gather information from all the above stages and take the most appropriate decision. It also contains not just the knowledge someone can get from educational institutes, but also knowledge through experiences at the working environment, as well as any kind of training or education offered by the companies, so as to cultivate the skills of their personnel (OECD, 2016).

In order to be able to analyze in the best way the projected results, we are going to use an index that expresses the percentage of the employed persons with ICT Specialist Skills, which for ease of use we are going to name S and it is calculated through the following formula:

$$S = \frac{Employed\ p.\ with\ ICT\ Sp.\ Skills}{Employed\ persons} \times 100 = \%Employed\ persons\ with\ ICT\ Sp.\ Skills$$

The recent years a very popular tool among the researchers of countries' digital efficiency has been proven to be the *Digital Economy and Society Index (DESI)* which is a complex summary of basic indicators depicting the digital performance of every E.U. member state and how high they score in digital competitiveness when compared to the other member state. It measures the performance indicators of five main categories:

- Connectivity, which measures broadband network coverage within the region of each member state.
- Human capital, regarding the people equipped with the proper digital skills.
- Use of Internet, by citizens and to what extent.
- Integration of Digital Technology, in industries and business sector.
- Digital public services, measuring the amount of public services that can be contacted online by each member state.

The above mentioned categories are further analyzed into various sub-categories. For the purposes of our study, we are going to focus on the category of human capital, so as to be able to correlate the extracted data to unemployment if possible, as well as to integration of digital technology in order to grasp the general trend of businesses regarding digitalization.

The following index has been published recently, and this is the reason why the chronological span of data is so limited and it concerns the 28 countries consisting the European Union. In fact, the responsibility of the publication was received by a contractor who was about to calculate the index from 2013 to 2017, or as recent as possible when these years are not available.
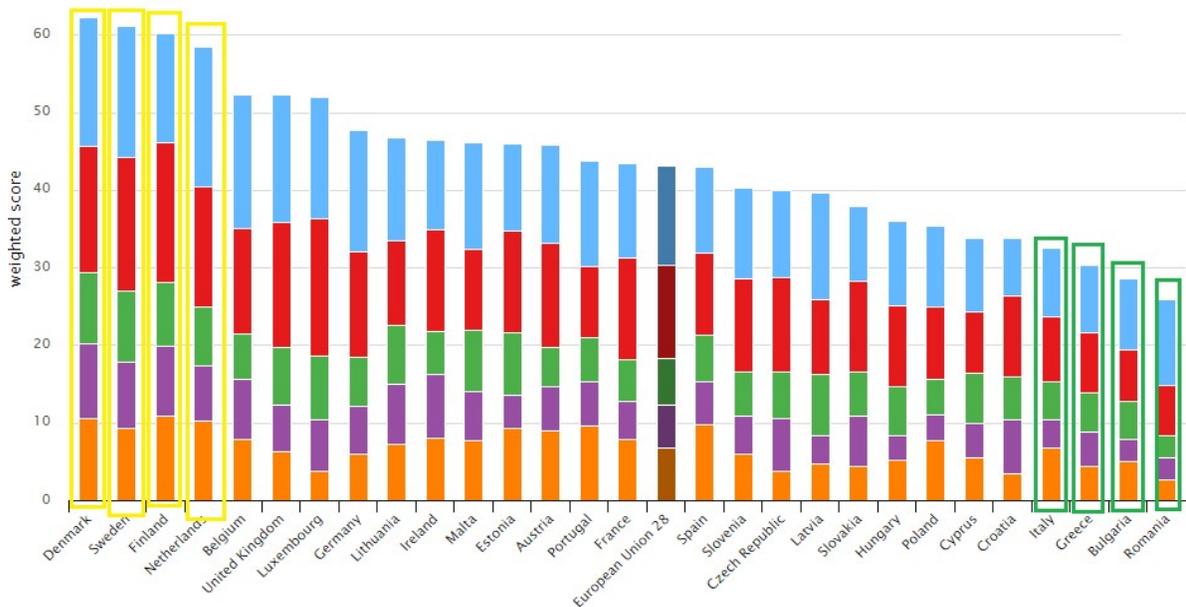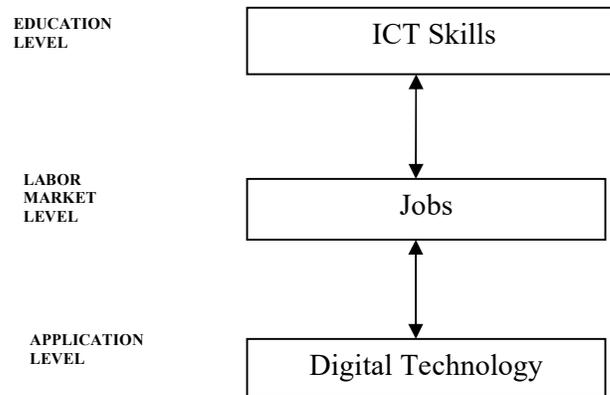

Figure 2: The Digital Economy and Society Index 2017 ranking (Source: DESI, 2017)

Science, Technology, Engineering, and Mathematics (STEM) is a term used to put together these academic disciplines and addresses education policy and curriculum choices to improve competitiveness in science and technology development (McComas, 2014).

4. METHOD

The proposed method is based on a 3-level approach (Figure 3).

EDUCATION
LEVEL

| ICT Skills |

LABOR
MARKET
LEVEL

| Jobs |

APPLICATION
LEVEL

| Digital Technology |

Figure 3. The 3-level approach

ICT skills are the necessary ICT skills to be possessed by the employees and correspond to the *educational level*. In the *application level*, the degree of *digital technology* impact is measured with DESI index. Finally, between the aforementioned levels is the *labor market level*. The employment rate is the variable used to measure the jobs (i.e the percentage of employed persons over the total number of employees). The employment rate is the complement of the unemployment rate.

We do a secondary survey for digital technology impact, job covered and skills possessed and how these apply, based on three variables (DESI, Employment rate and ICT Skills) based on two mappings: (a) between educational level and labor market level, and (b) between application level and labor market level.

At a first glance on the overall DESI score (Figure 2), we can observe that Denmark, Sweden, Finland and Netherlands are located at the top of the board, as they present the highest scores, while the lowest scores are achieved by Italy, Greece, Romania and Bulgaria. However, the highest scores do not automatically mean that they are the best in every category of indicators. We use as examples, the 4 countries with the highest values in DESI (best case) and the 4 countries with the lowest values in DESI (worst case). In these eight cases we correlate: (1) DESI with Employment rate and (2) ICT skills with Employment rate.

5. EMPIRICAL STUDY

Our analysis uses basic information of the aforementioned 8 countries. Table 1 portraits the attributes of the countries with highest DESI.

**Table 1. Attributes of the countries with highest DESI**

	Denmark	**Sweden**	**Finland**	**Netherlands**
Inhabitants	5.781.190 (2018)	10.128.320(2018)	5.516.812 (2018)	17.188.222(2018)
EU member since	1/1/1973	1/1/1995	1/1/1995	1/1/1958
GDP growth	1.5% (2017)	3.2% (2016)	2,1% (2016)	2.2% (2016)
Pension Age	Men 65 (2015) Women 65 (2015)	Men 63 (2018) Women 63, (2018)	Men 65 (2008) Women 65 (2008)	Men 65 and 3 months (2015) Women 65 and 3 months (2015)
Employment (%) Unemployment (%)	93.822% (2016) 6.178% (2016)	93.010% (2016) 6.990% (2016)	91.173% (2016) 8.827% (2016)	93.988% (2016) 6.012% (2016)
DESI rate	0.671 (2016)	0.647	0.655 (2016)	0.647 (2016)
ICT Specialists Skills/ Employed Persons*	3.708	5.848	5.896	4.380

Denmark with 92% of its population being regular Internet users appears also one of the highest shares of ICT Specialists. Furthermore, the adoption of digital technologies rate remains on top among the European countries and a large percentage of Danish businesses turnover comes from e-commerce. Denmark ranks 1 among EU countries and is part of the group of countries that are lagging ahead.
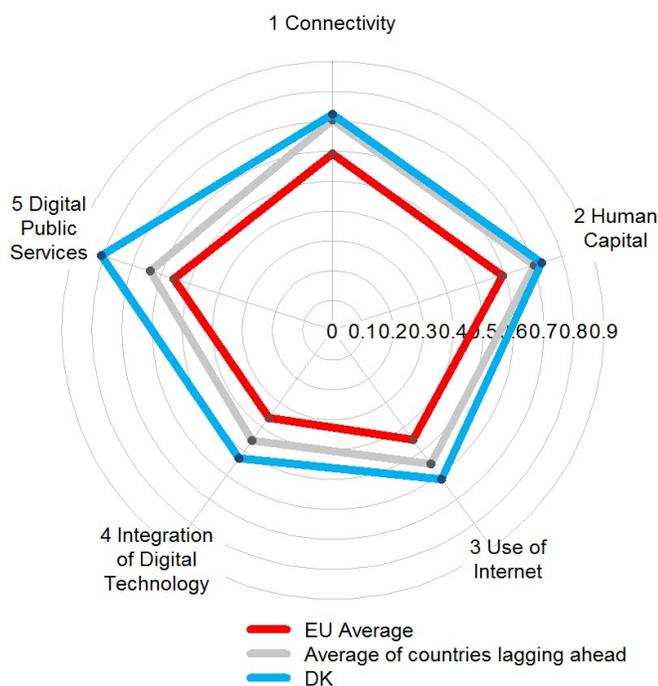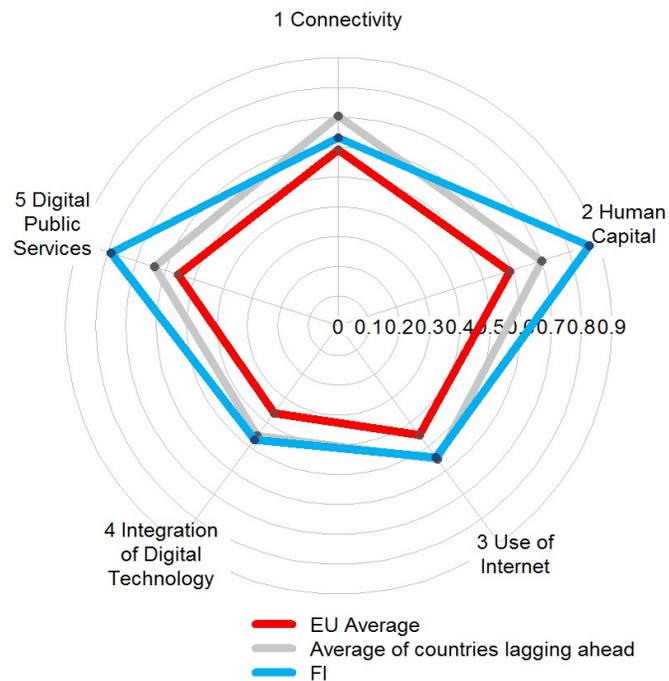

Figure 4. Denmark's performance in the DESI 2016

In Sweden where 91% of the population uses the Internet, despite the high ranking on ICT specialists' researches show that demand for ICT professionals surpasses the supply. Thanks to the great adaptability of businesses on digital technologies, Sweden ranks 2 among EU countries. It is part of the group of countries that are lagging ahead.
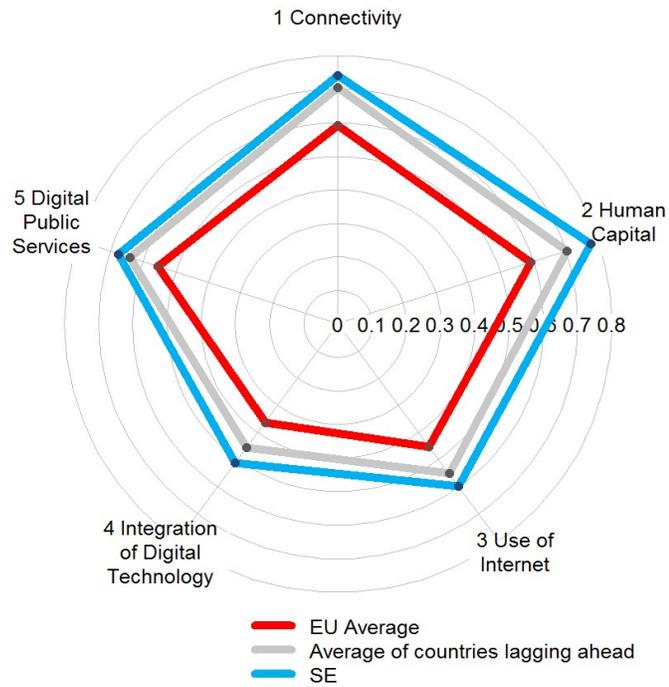
Figure 5. Sweden 's performance in the DESI 2016

With a high percentage of users with basic digital skills Finland scores equally high on STEM graduates. Besides, there is a quite big adoption of new technologies rate. Finland ranks 3 among EU countries. It is part of the group of countries that are lagging ahead.

Figure 6. Finland' s performance in the DESI 2016

Due to a range of successful programs, Netherlands manage to reduce any skill shortage problem with the simultaneous increase of competitiveness. However, on the business sector there is still room for improvement regarding utilization of digital technologies. Netherlands ranks 4 among EU countries. It is part of the group of countries that are lagging ahead.
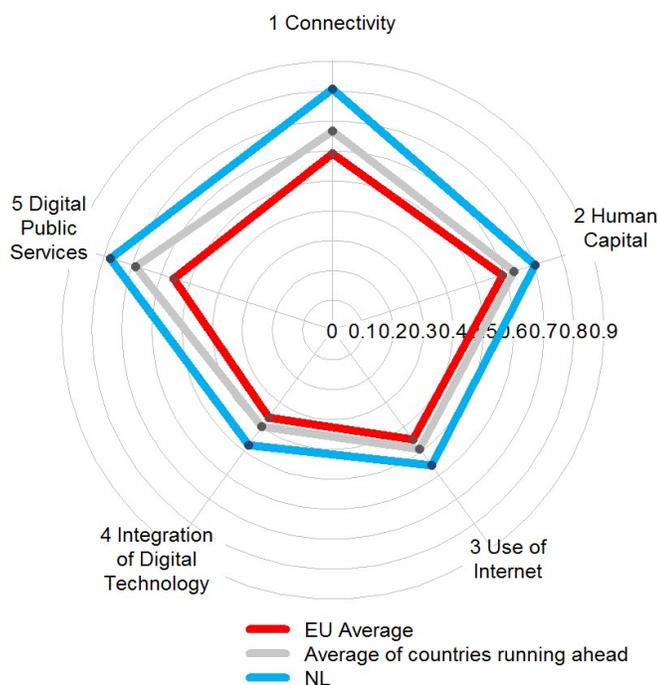

Figure 7. Netherlands' s performance in the DESI 2016

Table 2. Attributes of the countries with lowest DESI

|	**Italy**	**Greece**	**Bulgaria**	**Romania**
Inhabitants:	60.507.590(2017)	10.816.286(2011)	7.050.034 (2017)	19.638.000(2017)
EU member since:	1/1/1958	1/1/1981	1/1/2007	1/1/2007
GDP growth	0.9% (2016)	-0.2% (2016)	3,9% (2016)	3,8% (2017)
Pension Age:	Men 66 and 3 months(2015) Women 63 and 9 months, (2016)	Men 67 (2015) Women 67 (2015)	Men 64 and 4 months(2015) Women 61 and 4 months (2015)	Men 65 (2018) Women 60 and 9 months (2018)
Employment (%): Unemployment (%):	88.312% (2016) 11.688%(2016)	76.462% (2016) 23.538% (2016)	63.4% (2016) 6.7% (2016)	61.6% (2016) 5.9% (2016)
DESI rate:	0.383 (2016)	0.354 (2016)	0.350 (2016)	0.306 (2016)
ICT Specialists Skills/ Employed Persons*	2.311	1.264	-	-

Table 2 portraits the attributes of the countries with lowest DESI.

Half of the Italian population have got no digital skills, and this along with a low percentage of population with a STEM degree, drag down the development of the economy. Moreover, a low turnover on e-commerce leads to a bad adoption of digital technologies rate. Italy ranks 25 among EU countries. It is part of the group of countries that are catching up.
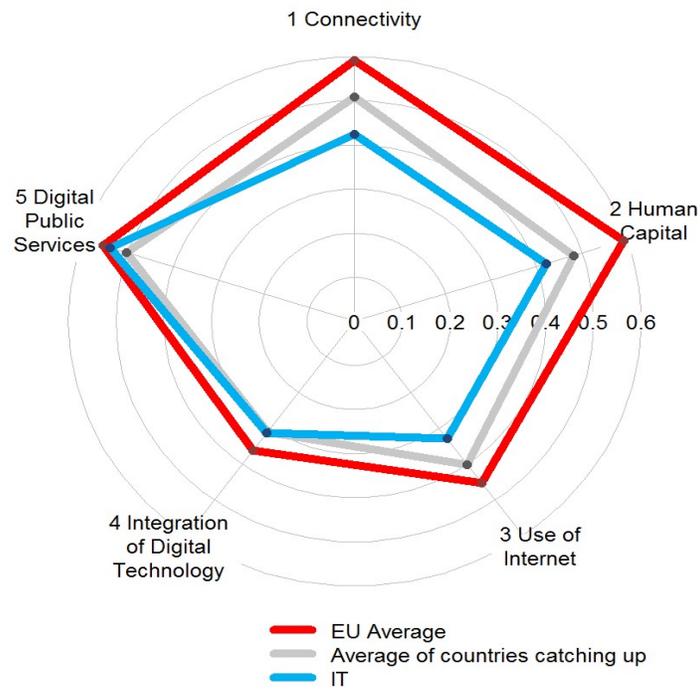
Figure 8. Italy' s performance in the DESI 2016

Due to the long recession period and the low percentages of Internet usage by the population, Greece is not the ideal case for digital technologies engagement. However, Greece proves to be a moderate performer in effective utilization of digital technologies. Greece ranks 26 among EU countries. It is part of the group of countries that are falling behind.
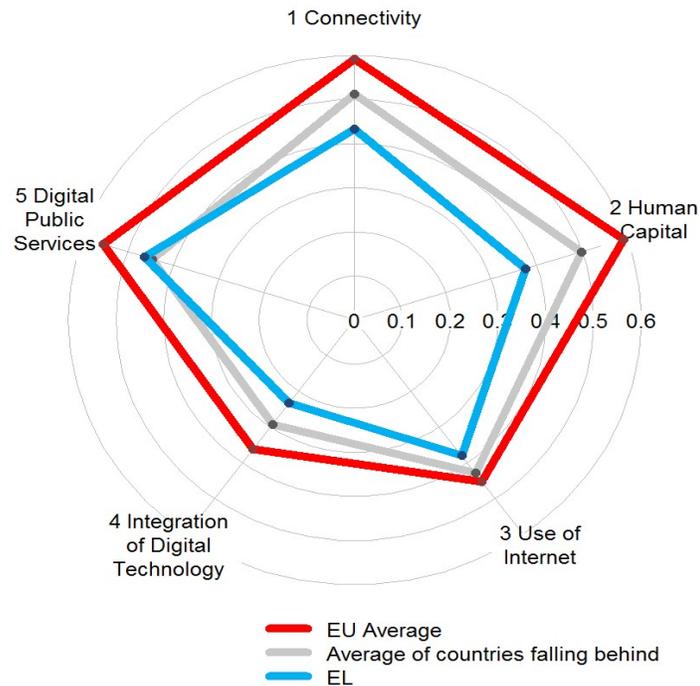
Figure 9. Greece' s performance in the DESI 2016

Finally, both Romania and Bulgaria suffer a severe gap of digital skills among their population and their adoption of digital technologies rate are among the lowest in Europe, with a negative effect to the development of their economy. Bulgaria ranks 27 and Romania ranks 28 among EU countries. They are parts of the group of countries that are falling behind.
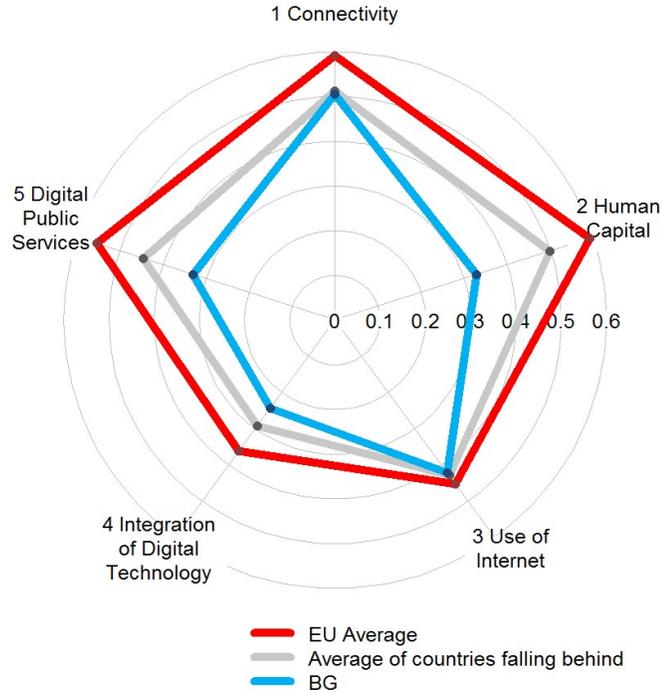

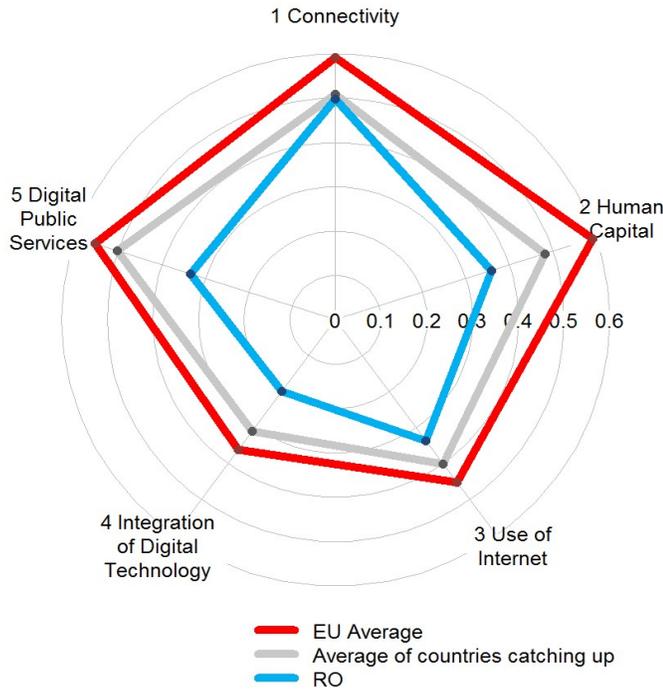**Figure 10. Bulgaria' s performance in the DESI 2016**

Figure 11. Romania' s performance in the DESI 2016

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The countries with low unemployment rate share a higher DESI, unlike Italy, Greece, Romania and Bulgaria, where a pretty high unemployment rate shares a lower DESI (table 3).

Table 3. Overall DESI with a highest and lowest score and Unemployment %

	2014		**2015**		**2016**	
	Overall DESI	**Unemployment %**	**Overall DESI**	**Unemployment %**	**Overall DESI**	**Unemployment %**
E.U.28Score	0.432		0.4628		0.5233	
Denmark	0.623	6.573	0.660	6.171	0.671	6.178
Sweeden	0.612	7.948	0.640	7.426	0.647	6.990
Finland	0.602	8.66	0.643	9.372	0.655	8.827
Netherlands	0.584	7.419	0.607	6.873	0.647	6.012
Italy	0.326	12.683	0.355	11.895	0.383	11.688
Greece	0.303	26.481	0.344	24.896	0.354	23.538
Bulgaria	0.286	11.400	0.338	9.200	0.350	7.6
Romania	0.259	6.800	0.287	6.800	0.306	5.9

We examine the four best countries in terms of DESI: Sweden, Finland, Denmark and Nederland. We also examine the four worst countries in terms of DESI: Italy, Romania, Bulgaria and Greece. 1. We correlated DESI with employment for the last 3 years and ICT skills with employment for the last 10 years (tables 4 and 5 respectively).

Table 4. Best case countries for 2007-2016

Country	Employment's mean (2007-2016)	ICT Skill's mean (2007-2016)	DESI's mean (2014-2016)	Correlation (Empl./ICT) (2007-2016)	Correlation (Empl./DESI) (2014-2016)
Finland	91.96%	5.8964	0.633	-0.651	-0.507
Sweden	92.44%	5.8484	0.633	-0.043	0.961
Nederland	94.78%	4.3795	0.613	-0.916	1.000
Denmark	93.83%	3.7082	0.651	-0.591	0.973

Table 5. Worst case countries for 2007-2016

Country	Employment's mean (2007-2016)	ICT Skill's mean (2007-2016)	DESI's mean (2014-2016)	Correlation (Empl./ICT) (2007-2016)	Correlation (Empl./DESI) (2014-2016)
Italy	90.10%	2.3113	0.3547	-0.927	0.690
Romania	93.39%	1.8280	0.2850	0.819	0.836
Bulgaria	90.56%	1.7690	0.3410	-0.406	0.689
Greece	81.68%	1.2643	0.3337	-0.791	0.944

From the correlations (Empl./ICT) it appears that when ICT is increasing, employment decreases. An exception is Romania, where, when ICT is increasing employment also increases.

6. DISCUSSION AND CONCLUSIONS

The main purpose of the paper was to investigate the labour job digitalization processes, the ICT skills and the employment rates in European countries, in order to cover the problem of labour deficit. The findings may be used as a starting point for the discussion on digitalization in this paper.

Technological change and globalization have significantly altered the landscape of local labor markets in Europe. The ICT skills are more important for workers than ever before. For those entering the workforce, this means that the skill set they possess will greatly influence the types of jobs for which they will qualify and the wage they can expect to earn. Those workers who are displaced from middle-skill jobs face a more difficult situation than those yet to enter the workforce because they often incur large and permanent wage losses and, in some cases, never fully recover from the job loss. Thus, determining how best to mitigate the consequences of job polarization for these workers poses a significant challenge. While there are no easy solutions to this growing problem, programs designed to help displaced workers retrain and build skills can improve both reemployment prospects and earnings potential. However, such programs vary in terms of their effectiveness, so it is important to determine how to best support programs that produce the most favorable outcomes.

Digitalization is one of the main drivers of technological change in the foreseeable future and central to this development is the production and use of digital logic circuits, and its derived technologies, including the computer, the smart phone and the Internet. Digital technologies affect the computerisation of production, service delivery and even the private sphere. Connectivity leads to completely new dimensions, as electronic devices and microprocessors connect people with each other, machines with workers, and machines with machines.

In recent years many European countries have been confronted with severe labour market problems, and in many of these countries levels of unemployment are significantly higher than a decade ago. In addition, these countries face several structural labour market problems. Firms frequently report difficulties to fill vacancies requiring workers with highly specialised skills. For individuals belonging to the "hard core" of unemployed, it has become rather difficult to find a job. And there are workers for whom the quality of their current employment is not fully satisfying either in terms of stability or in terms of wage levels. Such structural labour market problems can be found to a greater or lesser extent in almost all European countries. These problems are partly interrelated with the particular labour market performance of a country because they may either slow down a recovery of the labour market or may prevent further improvements.

The economic forces driving job polarization have existed for decades and are likely to continue. While these forces pose many challenges, they have allowed a significant and growing number of workers to become more productive and earn higher wages. Thus, given the reduction in opportunities for middle- skill workers, it is especially important to help people build the skills necessary to take on the high-skill jobs that these forces can create. Individuals, employers, educational institutions, and policymakers each have a role to play in helping the workforce adapt to this changing economic environment. Governmental policy makers will need to respond to the changing landscape by taking a leadership role and making education a national priority.

Although developments in digital technologies have already gained momentum, the main impacts of this new era of technological change remain to a large degree uncertain and still ahead of us.

The future of work depends on several factors, and the issues that are relevant in this context are the long-term competitiveness and the demographic development of a country. One of the important determinants for future labour market trends is technological change and since the beginning of industrialization two questions have always been raised. First, whether and to what extent technological change may actually destroy or create jobs; and second, what the impacts of technological change on the composition of employment are, e.g. regarding certain industries and occupations.

Rapid and accelerating digitization is likely to bring economic rather than environmental disruption, stemming from the fact that as computers get more powerful, companies have less need for some kinds of workers. Technological progress is going to leave behind some people, perhaps even a lot of people, as it races ahead. There's never been a better time to be a worker with special skills or the right education, because these people can use technology to create and capture value. However, there's never been a worse time to be a worker with only 'ordinary' skills and abilities to offer, because computers, robots, and other digital technologies are acquiring these skills and abilities at an extraordinary rate.

So what is the truth? The pessimists, who support that this time is different and machines really will take all the jobs, or the optimists, who insist that in the end technology always creates more jobs than it destroys? The truth lies somewhere in between. Digitization will not only cause mass unemployment, but it will speed up the existing trend of computer-related automation, disrupting labour markets just as technological change has done before, and requiring workers to learn new skills more quickly than in the past. Companies and governments will need to make it easier for workers to acquire new skills and switch jobs as needed. That would provide the best defence in the event that the pessimists are right and the impact of digitalization proves to be more rapid and more dramatic than the optimists expect.

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