The importance of digital literacy on the labour market

Journal:	*Employee Relations*
Manuscript ID	ER-07-2019-0274.R1
Manuscript Type:	Research Paper
Keywords:	digital literacy, digital transformation, labour force, employability

The importance of digital literacy on the labour market

Key words: *digital literacy, digital transformation, labour force, employability*

JEL codes: E24, E66, I25, J24

ABSTRACT

The purpose of the paper is to examine relationship among digital skills and employment and in this way accentuate importance of policy interventions for improving digital literacy. Digital skills, particularly digital literacy, are an important factor for socioeconomic development of the society and employability of the labour force. Without adequate digital literacy, it is not possible to participate in the economy and the digital society, particularly having in mind the digital transformation that the world of work is experiencing in the content and the organisation. Beyond the work environment, it also affects the way people live and communicate. In the paper is elaborated importance and definition of digital literacy, explained the measurement of digital literacy and skills, as well as relation between digital literacy and employability. Using Eurostat data this paper demonstrates statistically significant correlation between digital skills and employment rates in EU. This implies why it is so important for governments and employers to seek, propose and implement new strategies to promote digital inclusion, literacy and the training not only for new ICT professionals but for the whole workforce.

1. INTRODUCTION

Digitalisation has shown a strong impact on labour market by changing working conditions, job dynamics, and required knowledge and skills. It changes labour circumstances, creating both opportunities and risks. While numerous studies forecast millions of new jobs to be created, many jobs are at perils of disappearance due to digitalisation.

Digitalisation is not only the driver of economic growth, but is one of the key factors influencing these positive changes. Most new jobs will be within skill-intensive and knowledge-occupations, high-level managerial and technical jobs while jobs in elementary occupations will have lower increase. Despite millions of jobs might disappear due to automation, primarily in skilled manual work, potentials for new jobs, skills and growth are huge. Whether these new economic divides will be fair in the social context remains to be seen.

The impacts of digitisation on the labour market and employment are multiple, and have a high level of interconnection and mutual reinforcement. In many countries, the digitisation of the economy causes the polarisation of the labour market. On one side, digitisation has enabled a major increase in the demand for high-skilled persons that have cognitive and digital skills and technical knowledge to perform successfully the various tasks and processes required by the new technologies. On the other side, it has led to a stark decrease in the demand for low- and medium-skilled workers (Berger and Frey 2015). Valsamis et al. (2015) estimate that 40% to 60% of the available jobs in the EU are at risk due to digitisation-induced automation. They doubt that a digitalised economy will enable adequate demand for labour to compensate expected job losses. Moreover, digitisation is leading to the emergence of new jobs and creation of new occupations. It enables an increased demand for workers because it allows firms to produce better and more efficiently existing goods and services, and to make new products (Bainbridge, 2015). In digital age the content and the organization of work is changing in the way that the ongoing digitalisation implies an increasing automation as well as change of remaining tasks towards “brain and information work” so in consequence, digital literacy turns out to be a crucial key qualification (Parry, Strohmeier 2014).

OECD (2014) underlines that digitisation generates completely new occupations and jobs, like networking specialists, big data and internet engineers, hardware experts, data scientists, experts in cyber security, cloud and mobile computing, mobile app developers and others. Digitisation also significantly transforms existing jobs, changing to various degrees job contents and requirements as well as the way the working tasks are performed what cause the changes in the required skills (Valsamis et al. 2015). Humans of course have a comparative advantage over machines when it comes to cognitive tasks, which require improvising original solutions, thinking and resolving unexpected problems. Humans are also better than computers with tasks requiring flexibility to adapt and interpersonal interactions (De La Rica, 2015). Finally, in many industries and service provisions users will always prefer personal relationships with humans than that with the machine. For relations with human beings, one needs people, but of course with adequate knowledge and skills. Regardless of the positive or negative influence of the digitalisation on the labour market, a survey by ECDL Foundation (2018) shows that there is a shortage of digital skills and literacy in the EU that affects the whole population, including even the youngest generations. This is happening even in the most advanced countries like the United Kingdom (House of Commons, Science and Technology, Committee, 2016).

The goal of the paper is to examine relationship among digital skills and employment and in this way accentuate importance of policy interventions for improving digital literacy. After this Introduction, Section 2 is on the importance and definition of digital literacy, while Section 3 explains the measurement of digital literacy and skills. The fourth section explains relations between digital literacy and employability, while the fifth examines statistical correlation between digital skills and employment rates in EU countries. The final section contains conclusions.

2. THE IMPORTANCE AND DEFINITION OF DIGITAL LITERACY

Digital literacy, skills and competences have become crucial terms in the discussion on the kind of skills needed by citizens for successfully participation in the society. This is not only regarding citizens' social and digital inclusion, but also in terms of improving personal employability and enhancing economic growth (Ferrari, 2012; European Commission, 2016).

As digital technology becomes more integrated into the daily life and production in many economic sectors, digital literacy becomes of critical importance for the majority of employees. While some jobs are threatened by dismissal, a majority of existing jobs are going through a change in the required knowledge, competences and skill. This depends on the specificity of a particular industry, region and occupation as well as on the ability and power of different stakeholders to govern various social, economic and political changes (World Economic Forum 2016). The development and growth of digitisation have resulted in an increased demand of digital literacy, competences and skills, what is confirmed by many surveys (OECD, 2014; Curtarelli et al, 2016).

Theoretical discussion and practical experiences have showed that an increasing number of jobs require of the employees to use information and communications technologies (ICT) and possess digital skills. According to European Commission (2016), more than nine tenths of jobs need at least basic computer skill, while intensive ICT using occupations account for almost one fourth of the whole economy EU15 in 2010 (OECD 2016).

In the middle-skill job market there is an increasing division between jobs that demand digital skills and those that do not. The available data show (OECD, 2016; Curtarelli et al, 2016) that digital literacy and skills are required in more and more jobs and have become transversal competence. Transversal competences is a set of competences related to attitudes, values and procedures that can be easy transferred from one specific professional field to another.

With the constant change of digital technology and the services based on it, digital literacy and competence must continuously be modernised, to avoid or minimise the risks of digital exclusion. Digital exclusion is the lack of technology resources and access for poor or marginalised people. It is largely related to a lack of digital literacy and competence, rather than access to technology and services. Risks of digital exclusion reinforce social exclusion, which is itself often an important cause of digital exclusion. In the UK, for example, an estimated 10% of the population may never be able to gain basic digital skills because of old age, poor literacy skills and/or severe disabilities. These people are at particular risk of becoming digitally excluded (Ipsos Mori, 2015). As well as being more likely to have poor digital literacy and skills in general, most of mentioned social groups are also more likely to have no access to the internet. According to Erstad (2010) participation in the digital area is no longer a question of "have" or "have not", but rather an issue of competence.

Ferrari (2013) highlights the set of competences that are needed by citizens today for full digital inclusion. Socially excluded and isolated people, particularly those with low educational attainment and/or older age, lack the initial push, support and encouragement to learn using digital technology and to update their skills. In that way, they are at risk being further excluded. This exclusion is both socially - as social interactions and communication increasingly depend on application of digital media - and digitally - as most of new learning opportunities and media require a minimum level of digital literacy for their effectively finding and application (OECD, 2016).

Experts, international organisations, particularly OECD, and governments have constantly and progressively accepted the importance of digital literacy and skills within knowledge society and economies, both in the workplace and broader in society and economy. The literature on the phenomenon and importance of digital skills is very rich (Dolphin, 2015; European Commission, 2016; Eurofound, 2017, 2018). Despite the general covenant on the importance of digital skills, there is no common or official definition of this phenomenon, with diverse terms and explanations of the characteristics and content of digital competence as well as of the related knowledge, skills, and abilities.

Ilomaki, Kanotsalo and Lakkala (2011) explain that digital literacy or digital competence is the most recent concept describing technology-related skills. Over time various terms have been applied with a more or less broad scope to determine skills linked to the application and understanding of ICT and digital technologies. Such terms are ICT skills, information technology skills, technology skills, 21st century skills, digital and/or information literacy, and digital skills. These terms are almost regularly used as synonyms; e.g. digital competence and digital literacy. The well-known definition used in relation to this type of competences and skills denoted to *computer or ICT literacy* as declarative and procedural knowledge about computer use (Fraillon, Schulz and Ainley, 2013). With time, as modern technologies have encompassed more demanding and complex functions and the use of ICT has evolved, definitions that are more comprehensive have emerged. Mutka (2011) believes that they mirror the more ubiquitous and including role that these concepts currently have.

New Media Consortium (2005: 8) defines digital literacy as "the set of abilities and skills where aural, visual, and digital literacy overlap. These include the ability to understand the power of images and sounds, to recognize and use that power, to manipulate and transform digital media, to distribute them pervasively, and to easily adapt them to new forms". Sometimes the terms are narrow, referring only to a limited area of digital technology, for example, internet skills, and some of them applied to the widen content of literacy and media, for example, media literacy skills or digital literacy. Jenkins et al (2006) analyse the necessary digital skills through activities in a participatory cultural context. Speaking about 21st century literacy, they underlying social skills instead of individual skills.

The wide variety of terms reflects the rapid development of technologies but also different areas of interest, such as computer or library studies and/or data analysis. Furthermore, changes in culture and society, based on the new technology, have effects on terms. An example of such a definition is the one proposed by Jones et al (2008). They suggest, "Digital literacy represents a person's ability to perform tasks effectively in a digital environment; digital means information represented in numeric form and primarily use by a computer, and literacy includes the ability to read and interpret media, to reproduce data and images through digital manipulation and to evaluate and apply new knowledge gained from digital

environments". Digital literacy presents a number of perspectives on how the development of digital technologies changes conceptions of text, of writers and readers and finally of literacy itself (Erstad, 2010).

The evolution and variety of used definitions is related to and caused by several reasons. The problems in accomplishing one general definition are initiated mostly from the complexity and fluidity of the notion, which is constantly expanding and changing due to the swift evolution and broadening of information and digital technologies in the economy and the society (Ala-Mutka, 2011). European Parliament and Council of the EU (2006) defined digital literacy and competence as "the confident and critical use of ICT for work, leisure, learning and communication". This definition implies that digital literacy and competence do not only include the operational application of digital devices, but also cognitive skills, capacities and attitudes. It also suggests that digital literacy is a transversal competence that enables people to acquire other competences. While this notion has been applied very often in diverse academic analysis and policy documents, both in a descriptive and normative way, it is still not a particularly clear and firm concept (Ferrari 2013).

Several authors (Eshet-Alkalai, 2004; Martin 2006; Eshet-Alkalai and Chajut 2010, Ala-Mutka, 2011; Ferrari 2012) tried to develop the concept of digital skills, by defining the components and elements it includes and narrating in practice the skills and competences it encompasses. Their goal was to enable an assessment or a measurement of the competences and skills as well as to improve the understanding and the development of digital competence in the society. The developed conceptual and practical frameworks have been applied for both policy-making goals and for the evaluation and the certification of learning programmes and practices (Ferrari, 2012). For example, the Digital Agenda for Europe (European Commission 2010) "aims at maximising the growth potential of the digital economy, by promoting digital skills and high performance computing, digitising industry and services, developing artificial intelligence and modernising public services". The Agenda envisages the development of EU-wide indicators of digital and media literacy and competence. It leads to the establishment of the DigComp charter on digital skills and competence which was accepted to aid policymakers in preparation and implementation of efficient education and adult learning policies.

Generally, digital literacy and skills include an array of mutually related concepts. Analysing the rich literature sources, Curtarelli et al (2016) identify three main categories of digital skills, which are applied in different ways in numerous frameworks for the measurement and/or development of digital skills and competence. These three categories can be used to various types of abilities and are linked to the capacity to perform demanding and complex tasks. In such a way, they can be also applied to various types of users. The first group are *basic digital literacy competences and skills* that enable a person to become digitally literate. Such skills can be useful both to the workforce and to population in the knowledge economy and society. The second group are *digital skills that are related to employment.* They encompass basic skills and skills needed in a workplace. The third group are *digital skills for ICT professions*, which include both mentioned categories plus the skills needed in the ICT sector. They usually include creating and an innovative component, and are related to the capacity to develop new digital solutions products and services.

Much research dedicated to the definition of digital skills has been particularly oriented towards the skills needed by the workforce and employment as factors of employability, economic growth and international competitiveness. Some of the obtained frameworks have

looked only at the skills and competences of ICT workforce. Thus, the definition by the European e-Skills Forum (Gareis et al, 2014; Hüsing et al, 2015) classifies the e-skills of the labour force, with a particular attention on ICT practitioners with the goal to better define the e-skills gap and policy initiative measures across Europe. Starting from this framework, numerous other surveys have described the development of e-skills and competences demand and supply with regard to ICT workforce.

Cedefop (2015) differentiates between basic, moderate and advanced ICT skills, which relate to different levels of literacy, competence and skills as well as type of tasks realised by the employees. In a similar way, the OECD (2004) identifies basic users, advanced users and ICT specialists, having in mind a task-based approach with regard to the employed workforce. OECD (2016) has developed the concept of generic, specialist and complementary skills to identify the three main lines along which new digital skills are required. European Commission (2018b) in *Digital Competence Framework 2.0* defines the key components of digital literacy and competence in five areas:

1) *Information and data literacy*: To articulate information needs, to locate and retrieve digital data, information and content.
2) *Communication and collaboration*: To interact, communicate and collaborate through digital technologies while being aware of cultural and generational diversity.
3) *Digital content creation*: To create and edit digital content To improve and integrate information and content into an existing body of knowledge and to know how to give understandable instructions for a computer system.
4) *Safety*: To protect devices, content, personal data and privacy in digital environments.
5) *Problem solving*: To identify needs and problems, and to resolve conceptual problems and problem situations in digital environments.

Undoubtedly, the definition of the phenomenon of digital literacy is important but not quite clear and unambiguous. What is even more significant is the measurement of digital literacy as an indicator for policy success in achieving employability of the labour force and competitiveness of the economy.

3. MEASUREMENT OF DIGITAL LITERACY

The OECD Programme for the *International Assessment of Adult Competencies* (PIAAC) survey enables a direct measurement of adult digital skills and competences. It has been applied to assess the demand for ICT literacy and skills at work (OECD 2015), and to evaluate and to measure skill mismatches in the economy. The research by Pellizzari et al (2015) provides very detailed information on education and employment for a collection of comparable representative samples of 24 OECD and OECD partner countries. They also analyse tests of competencies to all respondents in three key areas: literacy, numeracy and problem solving in Technology Rich Environments (TRE). The PIAAC model on problem solving in TRE is above all interesting because it demanded of respondents to solve problems on a computer, like finding the quickest route between two locations using electronic maps and searching a reference in an electronic library. Skills and competence in this domain is thus informative about the degree of ICT knowledge of the labour force and it can be used to provide measures of e-skill mismatch. Regarding age, there is the clear generational gap among non-users of modern technology. Thus, more than a half of those who do not have prior computer experience are in the age group 55-65 while the same situation is with only 1.5% in the age group 16-24. In addition, older generations are also overrepresented among

those that either opted out or failed the test. Finally, there is a strong negative correlation between those who have no ICT skills and the level of educational attainment, so higher educational level means better ICT skills.

The Digital Competence Framework is a useful instrument to evaluate citizens' digital skills and competences and to support the development of the curricula. For preparation of policy measures it can be useful to know digital literacy and skills at the country level. The EU-wide Digital Economy and Society Index (DESI) provides an indicator for digital skills that uses the DigComp framework. DESI is a composite index that recapitulates important data on Europe's digital performance and tracks the changes in EU Member States regarding digital competitiveness (European Commission, 2018d). The "digital skills" indicator is one part of the multiply indicators to measure human capital, which is needed to take full advantage of the possibilities provided by a digital society. Denmark, Sweden, Finland, and the Netherlands have the most advanced digital economies in the EU, followed by Luxembourg, Ireland, the UK, Belgium and Estonia. On the other side, Romania, Greece and Italy have the lowest scores on the DESI. The Human Capital dimension of DESI has two sub-dimensions including *basic skills and usage* and *advanced skills and development*. The former includes data on internet use by individuals and digital skills (persons with at least basic skills defined by the Digital Skills Indicator). The latter dimension comprises indicators on ICT specialist employment and graduates in STEM (Science, Technology Engineering and Mathematics) disciplines. According to 2017 data, the Netherlands, Sweden and Luxembourg are the top performers in basic skills and usage; Finland, Ireland, Sweden and the UK had the highest scores in advanced skills and development. Romania, Bulgaria, Greece and Italy rank lowest overall on DESI's Human Capital dimension. (European Commission (2018b).

The Digital Skills Indicator is a composite indicator based on the European Commission's digital competence framework. It shows that in 2016 almost one fifth of the EU population had no digital skills. The main reason was that they did not use the internet or did use it only rarely. Around 44% of the EU population in 2016 can be deemed as lacking sufficient digital skills insofar as they had either low or no digital skills. Thus, they did not possess the minimum basic digital literacy skills to satisfy current labour market needs. Approximately around 60 million people in the EU have learned to use the Internet over the past decade, but despite constant improvement data signal a strong need for intensity efforts to improve the digital skills of European citizens. (European Commission, 2018b).

The data from the Digital Economy and Society Index (DESI) and the *European Digital Progress Report* (EDPR) are together used in the Digital Agenda Scoreboard. The Scoreboard enables to compare countries' digital performance in the areas of connectivity, human capital, internet use, integration of digital technologies, and digital public services. *The Annual European Digital Progress Report* contains benchmarks developments in digital literacy and skills in six domains: connectivity, human capital, internet use, digitisation of businesses, digital public services and research and development. There are huge differences across Member States, with the share of people without adequate digital literacy and skills ranging from 3% in Luxembourg to 41% in Bulgaria and Romania. In ten of EU Member States (Portugal, Poland, Slovenia, Croatia, Lithuania, Italy, Greece, Cyprus, Bulgaria and Romania), at least one-quarter of the population had no digital skills in 2016. Furthermore, nearly three-quarter of the adult population in Bulgaria and Romania lack needed basic digital skills. Many of these Member States are also among those with the largest shares of internet users with low digital skills. While for the EU as a whole an average 30% of internet users have low digital skills, in Bulgaria mentioned share is 55% (European Commission, 2018b).

Across competence dimensions, the most urgent need for improvement relates to content and software creation. Without a doubt, the share of internet users with no skills in this area (i.e. those who had not performed any of the activities considered under this dimension, which range from relatively simple preparation of text and spreadsheet-based work to video arranging and coding) reached 28% in 2016. It is high compared to around 6% for those not having accomplished any of the information or communication activities. In 2016, the largest shares of internet users without software and content creation skills are recorded in Bulgaria and Romania (52% and 50%, respectively). On the other side, there is a high share of software-knowledgeable populations in Luxembourg, Denmark and Croatia (respectively, 69%, 63% and 59% of internet users with above basic skills) (European Commission, 2018b).

It is evident that advanced digital literacy and skills are becoming a precondition for entry into many jobs and have a wide range of applications, even beyond areas where they are required for core tasks. For this reason, the following part of the text explains how digital literacy influences workforce employability.

4. RELATIONS BETWEEN DIGITAL LITERACY AND EMPLOYABILITY

Knowledge, skills and competencies are essential prerequisites for competitive society, and some EU Member States are still in all these segments significantly below the EU average. One of the main difficulties of the labour market in these countries is a lack of qualified and skilled human capital, particularly regarding digital literacy and skills. Furthermore, in these countries there is a serious mismatch of educational output regarding the knowledge, competencies and skills on the one side, and labour market needs on another.

Employability is more than the capacity for getting a job. It includes the possibilities that people can relatively quickly adapt to the changing working environment, develop and enhance their capabilities and meet their professional goals and promotions. Employability is a main result of education and training of high quality, as well as a range of other policies. It incorporates competencies, knowledge and skills, which enable a person's ability to secure and retain a job, progress at work and successfully cope with change, secure another job if she/he so wishes or has been dismissed. People have highest employability when they have broad-based education and training, basic and portable high-level skills, including digital literacy, numeracy and computing capabilities, information and communications technology (ICT) skills, action planning and decision-making capacity, self-awareness and self-confidence and readiness for lifelong learning. Such combination of skills enables them to adapt to changes in the world of work. Lack of digital literacy and skills not only negatively influences employability, productivity and efficiency at the work place, it affects the possibility of getting a job, getting a promotion or a pay raise. Using PIAAC data, Pellizzari et al (2015) focus on this issue by looking at the responses to the following question: “Has a lack of computer skills affected your chances of being hired for a job or getting a promotion or pay raise?” In the selected EU member state, 5.4% of interview respondents reported that lack of digital literacy and skills has affected their career. The percentage of positive answers to this question is the highest in Poland (9.5%), following by Estonia (8.3%), U.K. (6.1%) and Ireland (5.8%). It is the lowest in Netherlands (3.6%), Sweden (3.9%), Czech Republic (4%) and Germany (4.1%).

With the intention to improve the situation, the European Commission has launched the *Digital Skills and Jobs Coalition* (European Commission, 2018c), which unites Member

States and stakeholders with a goal to develop a digital talent pool and to ensure that population and the labour force in Europe are appropriately equipped with adequate digital skills. The EU e-skills strategy and Grand Coalition for Digital Jobs are realised in coordination with the activities under *Education and Training 2020*. This is to be done through various measures and multiple actions, primarily in identifying and sharing best practices (including in terms of innovative funding opportunities) that can be replicated and scaled up. The Digital Skills and Jobs Coalition is one of the 10 concrete actions under the New Skills Agenda for Europe, which prioritises digital skills in all its actions policy-making.

However, a holistic action is still limited in a significant number of Member States. Furthermore, most countries lack a master strategy and/or the topic still does not attract continuous attention in policy-making across the different policy areas concerned. Typically, measures are taken for adapting the education system to the demands of a knowledge-based economy, but in some countries insufficient reference is being made to ICT practitioner skills and the need to boost supply of suitably qualified ICT professionals (particularly in Czech Republic and Luxembourg) (Gareis et al, 2013). With the intention to bright up a little the current situation, in next section statistical correlation between digital skills and employment rates in EU countries is examined.

5. DIGITAL SKILLS AND EMPLOYMENT RATE

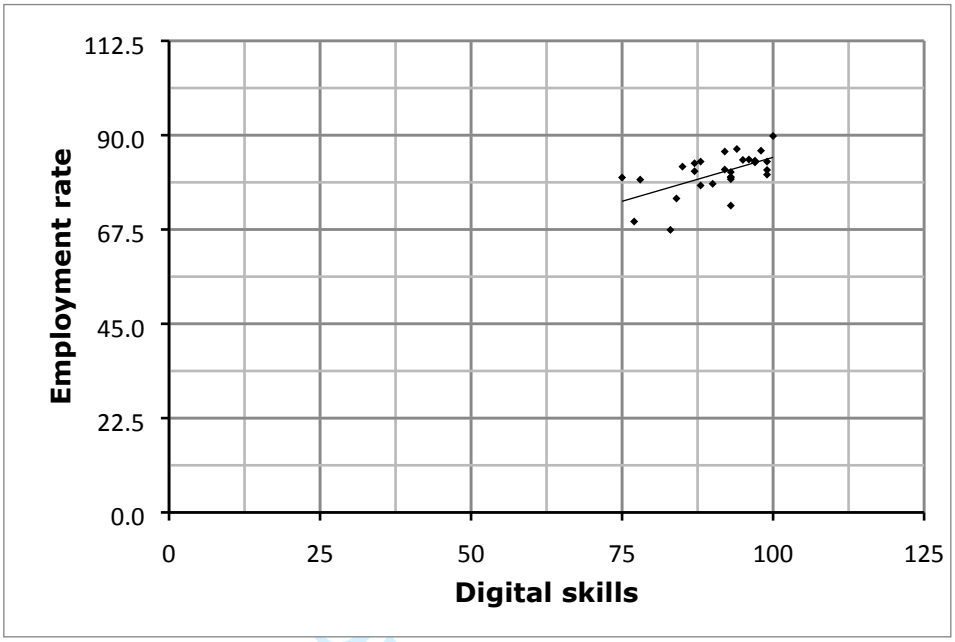
Eurostat data on digital skills and employment rates in EU member states allow for testing for correlation between these two variables. As previously mentioned, in all countries older generations tend to have lower level of digital skills, but also the largest differences among countries are in the digital skills of older generations. By comparing activity and employment rate differences among countries it can also be seen that largest differences are in employment of older workers. So it is important to test the relation of digital skills and employment rates for the generation between 55-64, as there are large differences both in digital skills and in employment rates among EU countries for this cohort.

Eurostat is publishing previously mentioned overall digital skills indicator calculated as a proxy of the digital competences and skills of individuals based on the component indicators from Digital Competence Framework. Indicators are based on survey of selected activities related to internet or software use performed by individuals aged 16-74 in four specific areas (information, communication, problem solving, software skills). It is assumed that individuals having performed certain activities have the corresponding skills. In this way four levels are assessed: "no skills", "low", "basic" or "above basic".

Various jobs will need different levels of digital skills, but for any employment one should have at least low digital skills. Obviously, employment rates and levels of digital skills in various countries are under influence of numerous combinations of factors which explanation would require complex modelling and considering of national specificities, but for the illustrative purpose in this paper Pearsons correlation through its simplicity and clarity suits much better. It shows how strong and statistically significant this correlation is, and gives easily understandable result usable for policy recommendations.

Comparing generations of prime age cohorts at labour market of age 25-54 shows as expected high employment rates and high percentage of those that have at least low digital skills (low, basic or above basic). There are no outliers and the correlation is positive but not very strong. Pearson's coefficient of correlation is $r = 0.59$ statistically significant with $p = 0.00078$.

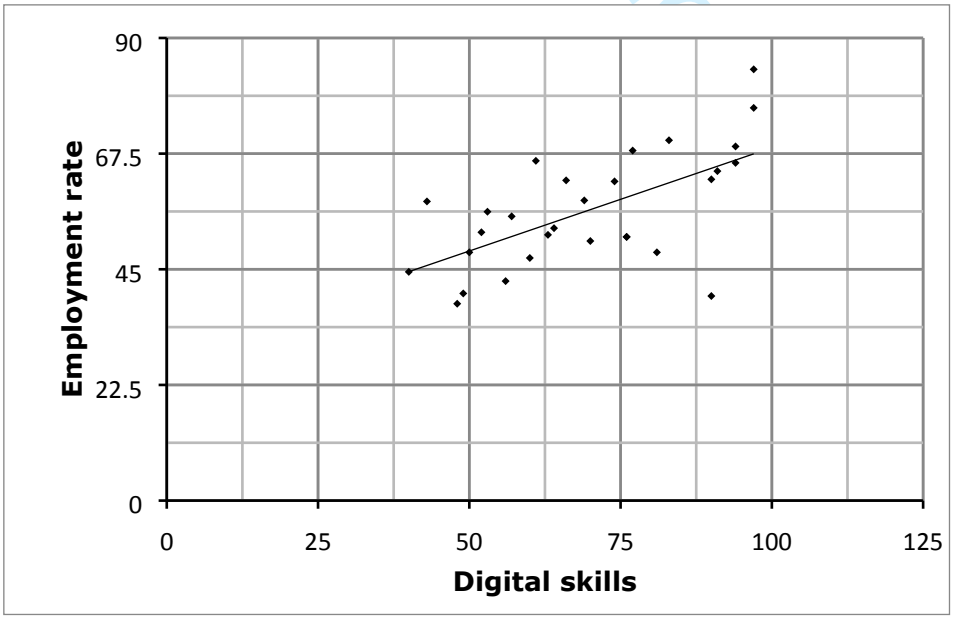
Graph 1: Digital skills and employment rate of population aged 25-54 in EU 2017



Source: Eurostat

The Graph 2 shows more dispersion in older generations, but also a higher correlation between digital skills and employment rate. Pearson's coefficient of correlation is r = 0.62, statistically significant with p = 0.0003, but with Luxemburg as atypical outlier with very high percentage of population with digital skills 90% and very low employment rate 40%. Without this outlier Pearson's coefficient of correlation rises very high to r = 0.77 statistically significant with p = 0.000002.

Graph 2: Digital skills and employment rate of population aged 54-65 in EU 2017



Source: Eurostat

It is obvious that there is circular interdependency while higher employment rate means that more people need to use computers every day so they will have at least low digital skills, as well as that people with at least some digital skills have more chances to be employed. Or from the other side, people without any digital skills have low employability and will remain inactive and while not employed, deprived of income their chances to acquire necessary digital skills will remain low. So, social exclusion will be related to digital exclusion. Digital competences from world of work help workers to adapt to other digital services and communication in their life. As lack of employment is main source of social exclusion, this strong correlation between digital skills and employment rate supports policies oriented to promote digital literacy in population that will help them to avoid the trap of digital exclusion and raise their chances to be active on labour market.

6. CONCLUSION AND RECOMMENDATIONS

The development of digital literacy contributes to the strengthening of knowledge-based society. Learners are able to understand and interpret meaning of a great quantity of information and share data online. Digital literacy learning provides participants with the initial training required to gain agile technology skills, and it supports learners' constant learning competencies, which will help them to navigate in a future career. The serious challenge for all stakeholders in the digital arena is to ensure that every citizen has adequate digital literacy, skills and knowledge and to insure that citizens are digitally connected in modern society.

Regarding the labour force, there is a high demand for new technical skills, as the jobs of around a half of the employed population will be transformed considerably in content and organisation. A significant part of the labour force will have to rapidly acquire or improve digital skills together with their cognitive, numerical, social and situational skills. Digital skills are more than desirable qualifications for potential employers. Therefore, they are among the key factors for dealing with joblessness, and are also preconditions for improving economic competitiveness and boosting economic growth.

The government should collaborate with employers and tech-industry partners to support development of industry-led, vocationally focussed digital careers advice in universities, and encourage schools and universities to provide 'code conversion courses' to help students from non-computer science backgrounds to enter the tech sector. Alongside maths and foreign languages, digital skills should be one of the core components of all apprenticeships, not just 'digital apprenticeships'. This will help to ensure the long-term future of the economy.

But not only digital competences for ICT professionals are important. Strong correlation between at least low digital skills and employment rate shows that broad action to achieve at least minimum digital literacy for population aged 54-65 is important mean to avoid digital and social exclusion as digital skills have become one of main factors of employability.

The government, educational institutions and employers should design new forms to assess digital skills, change standards to reflect the value of 21st century literacy, design and implement intervention programs for workforce digital skills development. For all these demanding tasks, there is a need for a strong partnership on the national and European level, where stakeholders work together to reduce the digital skills gap.

BIBLIOGRAPHY

Ala-Mutka, K. (2011). **Mapping Digital competence - Towards a Conceptual understanding,** Seville and Brussels: IPTS and European Commission,

Bainbridge S. (2015). **In the future, what will people do?**, In Dolphin, T. (ed.) (2015) ***Technology, globalisation and the future of work in Europe. Essays on employment in a digitised economy***. London: Institute for Public Policy Research, pp. 80-85.

Berger T. and Frey C. B. (2015). **Bridging the skills gap**. In Dolphin, T. (ed.) (2015) ***Technology, globalisation and the future of work in Europe. Essays on employment in a digitised economy***. London: Institute for Public Policy Research, pp. 75-79

Cedefop (2015). **Skills, qualifications and jobs in the EU: the making of a perfect match? Evidence from Cedefop's European skills and jobs survey.** Luxembourg: Publication Office of the European Union.

Curtarelli, M., Gualtieri, V., Shater Jannati, M., Donlevy, V. (2016). **ICT for work: Digital skills in the workplace** Bruxelles: European Commission.

De La Rica, S. (2015). **Equality of opportunity: Responding to polarisation in Europe's labour market.** In Dolphin, T. (ed.) (2015) ***Technology, globalisation and the future of work in Europe. Essays on employment in a digitised economy***. London: Institute for Public Policy Research. pp. 90-94.

ECDL Foundation (2018). **Perception & Reality Measuring Digital Skills Gaps in Europe, India and Singapore**, Dublin: ECDL Foundation, available on http://ecdl.org/media/perception__reality_report_-_ecdl_foundation_-_2018.pdf (accessed 2 January 2019)

Erstad, O. (2010). **Educating the Digital Generation**. *Nordic Journal of Digital Literacy*, 5(1), pp. 56-70. available on https://www.idunn.no/dk/2010/01/art05 (accessed 12 January 2019)

Eshet-Alkalai, Y. (2004). **Digital Literacy. A Conceptual Framework for Survival Skills in the Digital Era.** *Journal of Educational Multimedia & Hypermedia*, 13(1), pp. 93-106.

Eshet-Alkalai, Y., & Chajut, E. (2010). **You can teach old dogs new tricks: The factors that affect changes over time in digital literacy**. *Journal of Information Technology Education*, 9, pages 173-181.

Eurofound (2017). **Digitisation of processes - Literature review**, *Working Paper 17038*, Dublin: Eurofound.

Eurofound (2018). **Automation, digitisation and platforms: Implications for work and employment,** *Working paper 18002*, Dublin: Eurofound.

European Commission. (2010). **A Digital Agenda for Europe**. COM(2010)245 final, available on http://www.europarl.europa.eu/factsheets/en/sheet/64/digital-agenda-for-europe (accessed 12 January 2019)

European Commission (2016). **Europe's digital progress report 2016**, Bruxelles: European Commission, available on https://ec.europa.eu/digital-single-market/en/download-scoreboard-reports (accessed 12 January 2019)

European Commission (2018a). **Increase in gender gap in the digital sector - Study on Women in the Digital Age**, Bruxelles: European Commission, available on https://ec.europa.eu/digital-single-market/en/news/increase-gender-gap-digital-sector-study-women-digital-age (accessed 20 March 2019)

European Commission (2018b). **Human Capital Digital Inclusion and Skills: Digital Economy and Society Index Report 2018 Human Capital**, Bruxelles: European Commission.

European Commission (2018c). **The Digital Skills and Jobs Coalition**, Bruxelles: European Commission, available on https://ec.europa.eu/digital-single-market/en/digital-skills-jobs-coalition (accessed 12 January 2019).

European Commission (2018d). **The Digital Economy and Society Index (DESI)**, Bruxelles: European Commission, available on https://ec.europa.eu/digital-single-market/desi (accessed 2 February 2019)

European Commission (2018e). **The Digital Competency Framework**, Bruxelles: European Commission, available on https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework (accessed 2 February 2019)

Ferrari, A. (2012). **Digital Competence in Practice: An analysis of Frameworks.** JRC Technical Report, European Commission - Joint Research Centre. Luxembourg: Publications Office of the European Union.

Ferrari, A. (2013). **DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe**. European Commission, Joint Research Centre and Institute for Prospective Technological Studies. Luxembourg: Publications Office of the European Union.

Fraillon, J., Schulz, W., Ainley, J. (2013). **International Computer and Information Literacy Study - An Assessment Framework.** Cambera: The Australian Council for Educational Research, available on https://dern.acer.org (accessed 20 March 2019)

Gareis, K., Hüsing, T., Birov, S., Bludova, I., Schulz, C., Corte, W. B. (2014). **E-Skills for Jobs in Europe: Measuring Progress and Moving Ahead. Brussels: Final Report**. Brussels: European Commission.

House of Commons, Science and Technology (2016). **Committee Digital skills crisis Second Report of Session 2016–17,** London: UK Parliament, available on https://publications.parliament.uk/pa/cm201617/cmselect/cmsctech/270/270.pdf (accessed 12 January 2019)

Hüsing, T., Korte, W.B., Dashja, E. (2015). **E-Skills in Europe - Trends and Forecasts for the European ICT Professional and Digital Leadership Labour Markets (2015-2020).** *Empirica Working Paper November 2015*. Bonn: Empirica.

Ilomaki, L., Kanotsalo, A., Lakkala, M. (2011). **What is digital competence?** In Linked portal. Brussels: European Schoolnet, available on https://www.researchgate.net/publication/266852332_What_is_digital_competence_In_Linked_portal_Brussels_European_Schoolnet_httplinkedeunorgwebguestin-depth3 (accessed 2 February 2019)

Ipsos Mori (2015). **Basic Digital skills UK report 2015**, London: Ipsos Mori, available on http://s3-eu-west-1.amazonaws.com/digitalbirmingham/resources/Basic-Digital-Skills_UK-Report-2015_131015_FINAL.pdf (accessed 2 February 2019)

Jenkins, H., Clinton, K., Purushotma, P., Robinson, AJ., Weigel, M, (2006). **Confronting the Challenges of Participatory Culture: Media Education for the 21st Century**, Chicago: The MacArthur Foundation, available on https://www.macfound.org/media/article_pdfs/JENKINS_WHITE_PAPER.PDF (accessed 2 February 2019)

Martin, A. (2006). **A European framework for digital literacy**. *Nordic Journal of Digital Literacy*, 2, pages 151-161, available on http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.469.1923&rep=rep1&type=pdf (accessed 12 January 2019)

New Media Consortium (2005). **A Global Imperative: The Report of the 21st Century Literacy Summit.** Austin, Texas: The New Media Consortium, available on https://www.nmc.org/pdf/Global_Imperative.pdf (accessed 12 January 2019)

OECD (2004). **The ICT productivity paradox- evidence from micro data**. *OECD Economic Studies No. 38*. Paris: OECD.

OECD (2014). **Skills and Jobs in the Internet Economy**. OECD Digital Economy Papers No. 242. Paris: OECD Publishing.

OECD (2015). **Digital Economy Outlook 2015**. Paris: OECD Publishing.

OECD (2016). **New Skills for the Digital Economy: Measuring the Demand for ICT Skills at Work.** *OECD Digital Economy Papers No. 258.* Paris: OECD Publishing.

Parry, E., Strohmeier, S. (2014) **HRM in the digital age – digital changes and challenges of the HR profession**, *Employee Relations*, Vol. 36 Issue: 4

Pellizzari, M., Biagi, F., Brecko, B. (2015). **E-skills Mismatch: Evidence from PIAAC**. *Digital Economy Working Paper 2015/10*, Padova: Institute for Prospective Technological Studies.

Valsamis D., de Coen, A. Vanoeteren, V., Van der Beken, W., (2015) **Employments and Skills Aspects of the Digital Single Market Strategy**. Study for the EMPL Committee, European Parliament. Brussels: European Union.

World Economic Forum (2016). **The Future of Jobs. Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution.** Geneva: World Economic Forum.