



Article

Digitalization and Labor Market—A Perspective within the Framework of Pandemic Crisis

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Abstract: The current pandemic crisis, which is far from being over, has led to a significant paradigm shift in economics. In a turbulent environment in which the labor market has encountered a long series of changes generated by the processes of automation, robotization and digitalization, the COVID-19 pandemic has revealed that a workforce with digital skills can quickly adjust to new circumstances. Since novel issues, such as restrictions on internal movement and distorted supply chains, put major stress on the labor market, it seems that there is an urgent need for reshaping economies and following up-to-date technological trends. Moreover, prior to the COVID-19 pandemic, a significant number of scholars and policymakers expressed their concerns about the volatility of employment and the weak ability of labor to adapt to new types of jobs. Within this framework, our paper aims to analyze the plausible impacts of digital efficiency on the future development of the labor market. Based upon the assumption that employment is facing ongoing challenges and the labor market is constantly being reshaped by technological trends, our study attempts to provide a pragmatic analysis of the effects of digital skills and the use of the Internet on salaries and wages in EU member states. Since, according to our results, the levels of salaries and wages are strongly correlated with digital proficiency and Internet usage, a consistent effort to increase the digital skills of individuals may be required to achieve a more effective and flexible labor market.

Keywords: labor market; new economic policies; employment; teleworking



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1. Introduction

Long before the pandemic crisis, the labor force all over the world was facing uncertainty, which is standard for and inherent to markets. However, the extent to which this uncertainty has been shaped by the rapid pace of technological progress is remarkable. Robotic process automation, remote working, computer science, electronics and communications, mechanical engineering, information technology, the digitalization of public administration, and other factors are the pillars of the future of work. Some authors have even stated that without the robotic process automation included in technological processes, companies will not be able to compete in the market [1]. Robots and automate processes, especially those that are repetitive, have thus generated a new concept: the robotic workforce.

One should consider that in the last decade, alongside automation, the Internet and digital skills have become increasingly important, while the correlation between higher salaries and digital skills has become more apparent. A series of empirical studies [2,3] reveal that continuous progress in digital and robotic technologies will eventually cause the demise of non-automated work. An analysis by the McKinsey Global Institute estimated that by 2030, in about 60% of occupations, at least a third of the constituent activities could

be automated [4]. Prospects of a future where many people will not have jobs due to automation are enhanced by additional publications [5,6]. Automation and complementary digital technology might emerge with unemployment and conversely with inequality; this is why people fear what the future will bring. Social and economic policies are to be implemented, such as education for new adaptive skills or, in the worst scenarios, provision of a basic income. Despite this insecure perspective, automation processes and digitalization are accompanied by some peculiar qualities: they free people of repetitive tasks, provide 24/7 availability, are convenient and helpful, lead to the elimination of risky jobs in dangerous situations, eliminate workflow inefficiencies and shore up productivity. These all are currently pillars of further growth, which the economic mainstream still supports.

Going back through the history of economic thought, one may easily notice that, written in the middle of the Great Depression, the famous article of John Maynard Keynes, *Economic Possibilities for our Grandchildren*, is still important due to his analysis of the standard of life of people, past and future. Keynes stated that until the Industrial Revolution of the 1700s, with few ups and downs, in practical terms the standard of life remained plain when it was not affected by plague, famine, or war. Furthermore, Keynes asserted that this slow rate of progress was due to two reasons: a lack of technical progress and poor management of capital accumulation [7]. As a good mathematician, John Maynard Keynes was hopeful about the future: with a capital increase of two percent a year, he claimed that the capital equipment of the world would increase by half in twenty years, and seven and a half times in a hundred years [7]. However, not all of his claims were optimistic; Keynes also pointed out the threat of technological unemployment in the future. Nevertheless, the economic problem was eventually solved, and the prognosis for the next one hundred years was an improvement in the standard of living of between four and eightfold more than it was in 1930. His famous words were as follows: "Three-hour shifts or a fifteen-hour week may put off the problem for a great while. For three hours a day is quite enough to satisfy the old Adam in most of us!" [7]. People have been waiting ever since for the fulfillment of this prognosis, but the working time has not only not reduced but has even increased. Nowadays, his predictions have taken shape, but there are different reasons for this, such as automation, technical progress, and the virtualization of face-to-face activities due to the pandemic crisis.

In October 2020, World Economic Forum published *The Future of Jobs Report 2020*, which focuses on the effect of the COVID-19 pandemic on the future of employment and draws attention to [8]:

- The rapid pace of technology adoption, without signs of slowing, which even accelerates in some fields where traditionally the outcome came from face-to-face interactions. Furthermore, cloud computing, big data, and e-commerce will consolidate their strategic importance.
- The existence of a "double disruption", enforced by the historical trend of automation against traditional work, along with the COVID-19 recession and the rising fear of accelerating social and material inequalities.
- The job destruction pace (6.4%) will be higher than the pace of the creation of new jobs (5.7%) until 2025.
- The significant lack of skilled jobs for the future labor market.

Historical expectations of a high quality of life with abundance and spare time seem unrealistic. Moreover, along with this economic paradox, non-cyclical crises such as the COVID-19 pandemic further decrease the chances of a leisurely future for the workforce.

Our research offers a critical perspective on the present debate of the future of work, under the challenging context of automation and digitalization and the unexpected pandemic crisis and its consequences. This debate targets economic and social aspects that collide to identify a suitable framework for understanding future challenges which are not yet entirely predictable. It illustrates, in general, how online or remote work will shape the future of employment and discusses what might be the short-term adjusting policies.

In addition, our research addresses some of the challenges generated by the COVID-19 pandemic.

The article is organized in five main sections. Following the introduction, the second section offers insights into the empirical and theoretical background, the third deals with the methodological framework, the fourth section focuses on the results and discussions, while the last section presents the main conclusions as well as the limits of our research.

2. Literature Review

The tendency to use ever-newer technologies in the majority of sectors became increasingly visible, generating transformations in all types of activities, including in labor [9,10]. Automation, robotic and artificial intelligence, and digitalization have far-reaching implications for the labor market [11]. All these processes might lead to the creation of more goods and services with less jobs and higher labor productivity. However, the same processes could give rise to the risk of technological unemployment or lower wages. At the same time, new technologies generate “new employment opportunities in different industries and in newly created markets” [12].

Some researchers have pointed out that beyond the positive, well-known effects, new technologies and digitalization can lead to growing inequalities, exacerbating job insecurity and threatening the availability of adequate employment opportunities [13].

Research in recent years has suggested that there will be a future decline in workforce-based activity due to digital technologies [5,14,15]. Similarly, field literature shows that a generally accepted point of view regarding the implications of digitalization on the labor market has not yet been reached. Thus, studies conducted by Atkinson and Wu [16], Dengler and Matthes [17], and Acemoglu and Restrepo [18] suggest that, even in the automation of routine activity, it would be possible to maintain long-term balance in the market by creating a large number of new jobs. In recent years, Schlogl and Sumner concluded that over 60% of jobs in developing countries are susceptible to automation [19]. Therefore, understanding the link between digitalization, job loss, and unemployment becomes important, especially as digitalization is positively correlated with the level of economic development [20].

The empirical literature on digitalization, automation, and the labor market is much richer in its analysis of the United States of America and other advanced economies, with a particular focus on labor share and the distribution of earnings and qualifications. Schlogl and Sumner [19], Acemoglu and Restrepo [18], and Leduc and Liu [21], among others, provide more theoretical foundations that complement this kind of literature. On the other hand, similar research in countries with developing economies is rather scarce. A significant study was conducted by IMF [22], which analyzed the link between labor market polarization and exposure to routinization in 85 economies, indicating the rising rate at which developing countries are exposed to routinization, while Petrakaki and Kornelakis' [23] studied the potential of labor polarization in developing countries.

The impact of digitalization on the labor market can be also examined in terms of recruitment. Manyika et al. [24] showed that recruitment and selection methods will be much more advanced, as there are already sophisticated digital tools for screening and testing applicants, for team building, and performance feedback [23]. This kind of platform used in the virtual environment can significantly reduce costs for small businesses that need specialized help, for example, for accounting or marketing assistance when launching a product [24]. Moreover, digitalization causes a change in human resource strategies from another perspective. Instead of traditional training and staff development within the organization, companies are now recruiting qualified specialists. Such a change of strategy does not require organizations to pay attention to the training of professional skills, implying time-saving and direct employment of those individuals who already possess the required skills and competencies [25].

In addition, new technologies and digitalization will influence autonomy and the redistribution of power between professional groups [23], which will have implications

including working autonomy, rights of privacy, and power to resist electronic monitoring and intrusive surveillance systems.

Digitalization contributes to changes in the structure of the labor market and in the formulation of a growing demand for information technology. The study by Kuznetsova et al. shows that there is a positive relationship between the level of computer and Internet use by employees in organizations and the percentage of part-time employees [26].

Digitalization has likewise left its mark on the evolution trajectory of jobs in the public sector. In recent decades, developed capitalist states have used digital technology as an advantage to provide public services and to restructure the public sector [27]. Digitalization influences all sectors of activity to a greater or lesser extent: we find it making its mark on personal skills and modus operandi specific to jobs in various fields—from education, tourism and services, to the automotive industry, the transport system, the service sector, contributing to innovation and the increase of labor productivity. For example, the way in which tasks specific to different jobs in the transport services system will be carried out will change, because the use of the Internet, as in other fields of activity, implies an increase in the speed and volume of information processing; this facilitates statistical accounting (e.g., online taxi) [28]. Moreover, the ability to collect real-time data allows for rapid analysis of information and facilitates management decisions [28].

Digitalization impacts the demand for various soft skills, such as teamwork, communication skills, and problem-solving skills [29]. According to a World Economic Forum report, a serious problem arises in this context: who will pay for employee retraining and how soft-skills will be developed in terms of critical thinking and analysis, problem-solving, active learning, resilience, stress tolerance, and flexibility [8].

Another issue connected with the impact of digitalization on the labor market relates to the disappearance of different jobs. There is a difference between the reduction of working time for a specific job and the total disappearance of a well-established, traditional job: human drivers, warehouse operatives, retail workers, journalists, financial traders, and many others. It comes down to redundancy and the availability of machines to replicate these activities. It might be easier and cheaper to hire machines instead of humans but is not always as easy as it looks. In addition, the forecasts for job automation by 2040 are presented as follows: half of the existing jobs in the United States of America and United Kingdom, two-thirds of jobs in India and three-quarters of jobs in China might disappear [2]. However, there might be some positive outcomes such as the freedom of personal spare time [30].

Still, the imbalances closely linked to the labor market are not new. Fresh opportunities have always emerged, and the extensive use of the Internet has revealed possibilities that past generations could scarcely imagine. Albeit a catalyst for consumerism, digital technology has undoubtedly prompted economic development. Furthermore, the wheels of capitalism keep workers consuming and working, in order to maintain the profit-making mechanism. Machines bring low cost for capital and, henceforth, there is a collision between machines and human labor as it appears to be a competition generated by the level of costs. However, workers' bargaining power has already become weak ever since the 1970s, due to a restraining welfare state and frail labor unions. The real menace is one that allows a persistent low quality of work. The real strength in the future of work should lie in a key frame with less and better work along with more personal spare time.

Field literature highlights two main perspectives. The first perspective claims that people will continue to search for work despite technological pressure because labor is important for its own end, and it is inherent to the welfare of human beings. The social dimension becomes important, as it is not only about the wages which practically pay for human living [5]. After March 2020, when the COVID-19 pandemic emerged, the disruption of the social dimension of work became a reality that was hard to endure for many. In 2020, there were over 20 million job losses in the USA alone [31]. Many jobs have made the transition to online platforms, but not all of them [32]; with time, the lack of social engagement became obvious. Furthermore, work is permanently preventing an

under-consumption crisis [6]. Therefore, if work as a social component of life is driven by automation towards sure demise, then governments need to implement regulations such as basic income to support workers, for example. The first perspective supports work as a natural consequence of social evolution and integration. The second perspective, on the other hand, states that work distorts human well-being due to requirements and mandatory tasks. The increased value of personal spare time over obsession for social recognition mainly related to work hierarchy should be the way toward creative activities for personal and spiritual development. With this perspective in mind, authors argue that automation is welcomed as it frees and leaves room for more personal time [30].

However, as proven many times, the economic future is subject to unexpected paradigm shifts and unpredictable non-cyclical crises. The COVID-19 pandemic forcefully accelerated online work in many areas of activity, and this fact alone changed labor market parameters to a significant extent [33]. The current context shows that any major change rapidly leads to a systemic rethinking of the entire labor market. To give just an example, the remote operation for many categories of activities brought to the forefront the political issue of personnel policy. Although remote work is already relatively common in many industries, not all companies have been prepared for the sudden shift to working from home. Moreover, not all companies have invested in human capital to cultivate digital skills.

In the current pandemic crisis, digital proficiency has become essential both for workers and enterprises [33]. Companies and organizations have had to quickly build e-commerce websites, develop applications and platforms, move document storage to cloud storage servers, and make everything faster and more accessible. However, the success of these operations essentially depended on the level of digital skills of their employees. In addition, the COVID-19 pandemic negatively affected other elements specific to the labor market: in part, it has managed to eliminate progress made in the field of gender equality in recent decades [34]. A series of studies claim that women around the world will have to pay an additional social tax as a result of a multiplied care work during the COVID-19 pandemic [34].

Since the current pandemic pushes many businesses to migrate towards the online environment, the aim of our efforts is to reveal how individuals' digital skills and appetite toward online activities is connected to their wage levels.

3. Materials and Methods

In this context, our main research objective is to analyze how the access to digital technologies and digital skills of individuals may impact the labor market performance. To reach the objective, we used data collected from the Digital Economy and Society Index, which measures EU digital performance. According to the European Commission Digital Agenda, there are a series of indicators which capture five main dimensions (Connectivity, Human Capital, Use of Internet, Integration of Digital Technology, Digital Public Services) that assess the European information society status. For our analysis, we selected nine indicators that relate to the Internet access and digital skills of individuals: (1) households with ultrafast fixed broadband connection; (2) NGA broadband coverage/availability (as a % of households), where NGA stands for Next Generation Access, which, according to the European Commission, includes the following technologies: FTTH, FTTB, Cable Docsis 3.0, VDSL, and other superfast broadband (at least 30 Mbps download); (3) individuals with an above basic level of digital skills (as a % of individuals) which assess individuals that have above basic digital competencies in the following domains: information, communication, content creation, and problem solving; (4) individuals with at least basic digital skills in Software domain (as a % of individuals); (5) individuals who are regular Internet users (at least once a week) (as a % of individuals); (6) individuals that have used the Internet, in the last 3 months, for completing an online course (for any subject) (as a % of individuals); (7) individuals that have used the Internet, in the last 3 months, for Internet banking (as a % of individuals); (8) individuals ordering goods or services online which means individuals

carrying out this activity over the Internet in the last 12 months, for private use (as a % of individuals); (9) individuals that have used the Internet, in the last 3 months, for selling goods and services (as a % of individuals). The indicators have been extracted in May 2021 from the latest Digital Agenda Dataset available for each EU member state.

The indicators for our analysis have been selected based on the assumption that they are more liable to the changes caused by the COVID-19 pandemic. A scrutiny on Eurostat available statistics reveals that in less than six months since the pandemics started (December 2019–June 2020) the EU average percentage of households with ultrafast fixed broadband connection, as well as NGA broadband coverage/availability has each increased by no less than 3 points [35]. Fixed broadband subscriptions in the OECD member countries have increased by 14% in 2020 relative to the previous year [36]. Moreover, whilst digital education is already a growing practice worldwide [35], the COVID-19 pandemic has pushed toward online learning most of the education and training programs [37] causing a rise in the EU average percentage of the individuals doing an online course from 8.43 in 2019 to 12.32 in 2020. The COVID-19 pandemic has also changed the way people do business stimulating individuals to sell or order goods and services online or use online financial services such as banking [38]. These shifts in consumer behavior along with other significant changes in social behavior triggered by the pandemic crisis have prompted people to become more regular Internet users. The sudden shift toward online activities added pressure on the individuals’ digital skills, while the intensified digitalization of business requires employees with at least basic digital skills in software domain. In the light of these arguments, it can be assumed that the selected indicators have been and will further be impacted by the current COVID-19 pandemic and their analysis could provide insights for a better understanding of these still in progress circumstances.

While there are countless indicators covering various labor market features such as employment, training, wages, or productivity, we use as a proxy for measuring labor market performance wage and salary per hour (in euro) earned by employed individuals. Wages and salaries might be a suitable indicator for labor market performance within the framework of the COVID-19 pandemic crisis for at least two reasons: first, there is still a significant polarization among EU member states in terms of salaries for the same type of jobs [39] and, second, according to ILO reports, labor income is very sensitive to the pandemic crisis [40]. Data on wage and salary per hour is provided by Eurostat for all EU member states except for Romania which does not disclose salaries and wages to Eurostat. In this case, data on wage and salary per hour has been collected and computed from reliable national statistics sources provided by the National Institute of Statistics.

Descriptive statistics of the collected data are presented in Table 1. The data analysis was conducted using SPSS 26 software.

Table 1. Descriptive statistics.

Variable	Min	Max	Mean	Std. Dev	Var	Skewness	Kurtosis
Doing an online course	2.305	21.204	8.688	4.562	20.809	1.107	0.931
Households with ultrafast fixed broadband connection	0.843	65.750	28.749	17.195	295.663	0.309	−0.678
Individuals ordering goods or services online	29.416	86.364	64.951	15.037	226.112	−0.776	0.258
Individuals selling goods or services online	3.213	37.988	19.007	9.742	94.904	0.188	−0.748
Individuals who are regular Internet users	66.839	95.463	83.938	7.698	59.256	−0.364	−0.476
Individuals with above basic level of digital skills	10.331	50.070	32.023	10.038	100.754	−0.145	0.125
Individuals with at least basic digital skills in Software domain	30.896	80.065	58.052	11.719	137.336	−0.316	0.156

Table 1. *Cont.*

Variable	Min	Max	Mean	Std. Dev	Var	Skewness	Kurtosis
NGA broadband coverage/availability	68.967	100.000	88.499	9.009	81.164	-0.652	-0.393
Individuals using online banking	11.348	95.201	65.617	21.046	442.921	-0.990	1.348
Wage and salary per hour (in euros)	5.400	39.400	18.221	10.011	100.230	0.592	-0.856

Source: authors’ own calculations based on Eurostat data.

Having in mind the significant number of indicators selected, we have conducted a factor analysis using PCA to condense these variables and capture the main components that could characterize the level of Internet access, usage, and digital skills of individuals. Performing the Kaiser–Meyer–Olkin test, we obtained a value of 0.776 ($p = 0.00$), which confirms that the sample is suitable for factor analysis. The results of the Kaiser–Meyer–Olkin test and Bartlett’s test of sphericity, which provides information on the adequacy of the sample, are displayed in Table 2.

Table 2. KMO and Bartlett’s Test—digitalization variables.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.776
Bartlett’s Test of Sphericity	Approx. Chi-Square	207.449
	df	36
	Sig.	0.000

Source: authors’ own calculations.

As displayed in Table 3, according to our analysis, there only two components with Eigenvalues greater than 1, which explains more than 76% of the total variance of data.

Table 3. Total variance explained.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.642	62.691	62.691	5.642	62.691	62.691	5.523	61.367	61.367
2	1.221	13.562	76.253	1.221	13.562	76.253	1.340	14.886	76.253
3	0.788	8.754	85.007						
4	0.467	5.185	90.192						
5	0.408	4.533	94.725						
6	0.213	2.362	97.088						
7	0.149	1.657	98.744						
8	0.080	0.891	99.635						
9	0.033	0.365	100.000						

Source: authors’ own calculations.

To capture the factor loadings, we performed rotation using varimax with Kaiser normalization and a rotation converged in 3 iterations. The rotated component matrix is displayed in Table 4.

Table 4. Rotated Component Matrix.

	Component	
	1	2
Households with ultrafast fixed broadband connection	0.018	0.786
NGA broadband coverage/availability	0.135	0.778
Individuals with above basic level of digital skills	0.942	0.118
Individuals with at least basic digital skills in Software domain	0.932	0.049
Individuals who are regular Internet users (at least once a week)	0.898	0.253
Doing an online course (in any subject)	0.793	0.179
Using online banking	0.889	0.071
Individuals ordering goods or services online	0.935	0.017
Individuals selling goods or services online	0.805	-0.010

Source: authors' own calculations.

4. Results

By performing factor analysis, our study divided initial variables into two main components. The first component is strongly correlated with the following variables: individuals with above basic level of digital skills, individuals with at least basic digital skills in the software domain, individuals who are regular Internet users (at least once a week), doing an online course (in any subject), using online banking, individuals ordering goods or services online, and individuals selling goods or services online. Considering these variables, the first component could be named digital proficiency and Internet usage. On the other hand, the second component is strongly related with the remaining two variables: households with ultrafast fixed broadband connection and NGA broadband coverage/availability. In this context, there are reasonable grounds to call this component Internet coverage. Our results reveal two components that are in line with the key dimensions promoted by EU digital agenda. Given that components scores “are composite variables which provide information about an individual’s placement on each component” [41], the two components’ scores were saved, using the regression method, as separate variables for further analysis. Figure 1 shows the relationship between digital proficiency and Internet usage component score and wages and salaries among EU-27 member states.

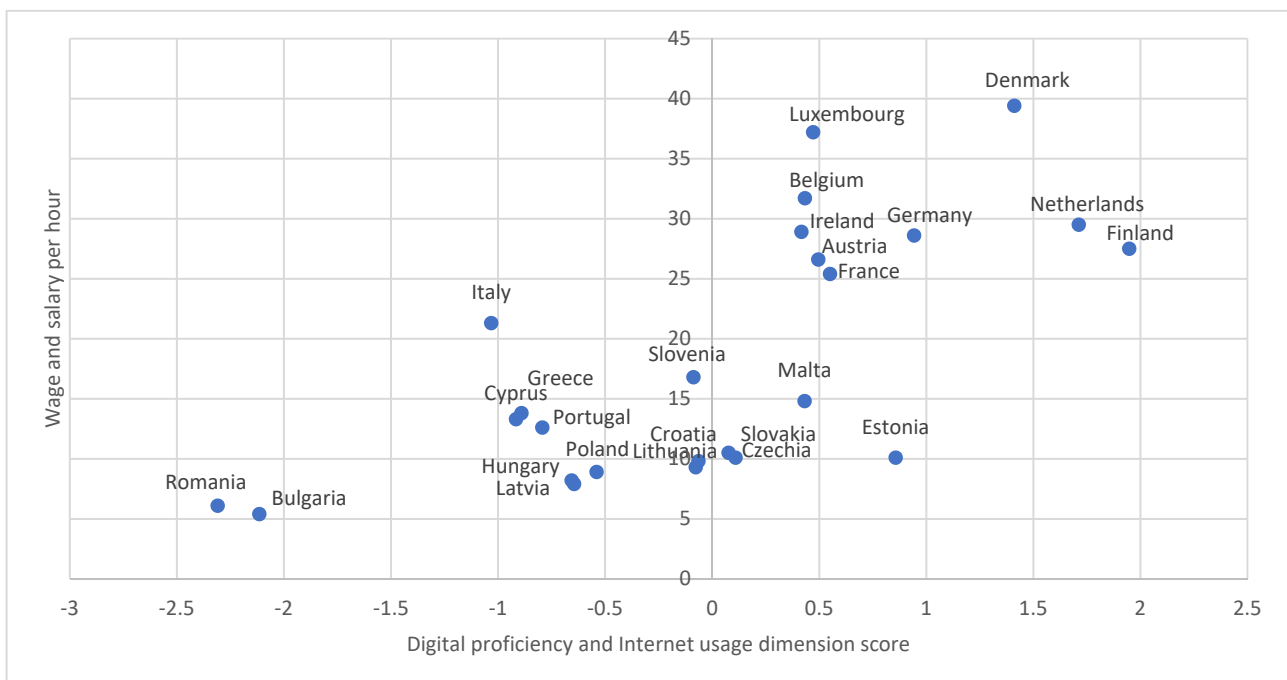


Figure 1. Digital proficiency and Internet usage component and wages. Source: authors' own calculations.

Our research reveals that there is a significant strong correlation (Pearson coefficient = 0.685, $p < 0.01$) between digital proficiency and Internet usage component score and wages and salaries. Moreover, one might easily notice that there is still a considerable gap between EU member states in terms of digital proficiency and Internet usage. Member states with higher scores on digital proficiency and Internet usage have higher wages. This result is very important, mainly because, on average, around 40% of adults in the EU are at risk of digital exclusion. In the case of European countries, the highest proportions of adults with low levels of digital skills and without digital skills—between 40% and 56%—were reported in Northern Macedonia, Bosnia and Herzegovina, Romania, Cyprus, Latvia, Bulgaria, Turkey and Poland, while at the opposite end are: Finland, Sweden, Iceland, Norway, Germany, the Netherlands, Austria, Switzerland, and the United Kingdom, where the proportion of people with low levels of digital skills and no digital skills is between 11% and 23% [42]. However, there is a cluster of EU member states (Lithuania, Croatia, Czechia, Slovakia) that may have a competitive advantage on the international labor market, as their digital proficiency and Internet usage dimension score is close to the EU average, while wages and salaries are below the EU average. We must also keep in mind that in the least developed countries, only one in five people use the Internet, compared to four in five in developed countries [43], which shows the importance of the digital divide. If left unaddressed, such gaps will exacerbate already perceived income inequalities.

Moreover, our results are in line with those obtained in previous studies, such as the one conducted by DiMaggio and Bonikowski [44], which showed that using the Internet significantly increases individual salaries but has a clear lower impact on salary premiums than the actual computer use. In addition, the existing imbalance in the distribution of the Internet resources in different regions of the world further widens the “digital gap” between rich and poor, thus increasing the income gap [40]. In this context, the information dividend inherent to the Internet use is usually exploited by those with a high socio-economic status, while people with low socio-economic status are excluded, which further increases the rich–poor divide. In addition, the heterogeneity of groups using the Internet widens the income gap, as highly skilled people can quickly adapt to new technologies; use of the Internet has a greater impact on the wages of highly skilled workers than on those of ordinary workers [45]. The study by Whitacre et al. [46] demonstrates this by highlighting the impact of the Internet use on middle-class incomes, which is significantly higher than lower-class ones.

In addition, our results are complementary to those obtained by Mora-Rivera and García-Mora [47], who approached the problem from another perspective: that of identifying the extent to which the Internet access influences the level of poverty. The above-mentioned research found that the Internet coverage has a positive effect on poverty reduction in both rural and urban sectors.

After the COVID-19 crisis hit, the usage of the Internet surged all over the world [48–50]. In this context, the categories of people who have problems using the virtual space have become more visible. Thus, it has been observed that people over the age of 65 find it more difficult to adapt to the new technology [51]. In addition, the pandemic also revealed the fact that small firms with limited technological capabilities have found it difficult to adapt their activity to the online environment, unlike their larger rivals [52]. Additionally, people living in limited broadband areas were less likely to work remotely, take online courses, or access telehealth [53].

Another issue to be discussed is related to the point that over time, it has been observed that in times of crisis, in order to save money, some companies resort to outsourcing activities, often involving specialists from other countries with lower salaries (IT outsourcing, remote call center, etc.) [25]. In this setting, digital skills gain importance, as they attract large companies to countries with cheap, well-trained labor. However, besides reducing the company costs, such situations may be accompanied by undesirable effects, because the process of knowledge accumulation of the new employees is disrupted if most employees are temporarily employed or leased, etc.

In addition, there are several studies underlining the importance of digital skills as an increasing factor of productivity, especially when working from home [54–56].

Since, according to recent estimation, almost 37% of jobs can be performed from home [57], the relationship between the Internet coverage component scores and wage and salaries per hour among EU-27 member (Figure 2) may well raise awareness of an urgent need for a rapid increase in investments in digital access as an opportunity to reduce the wage gap.

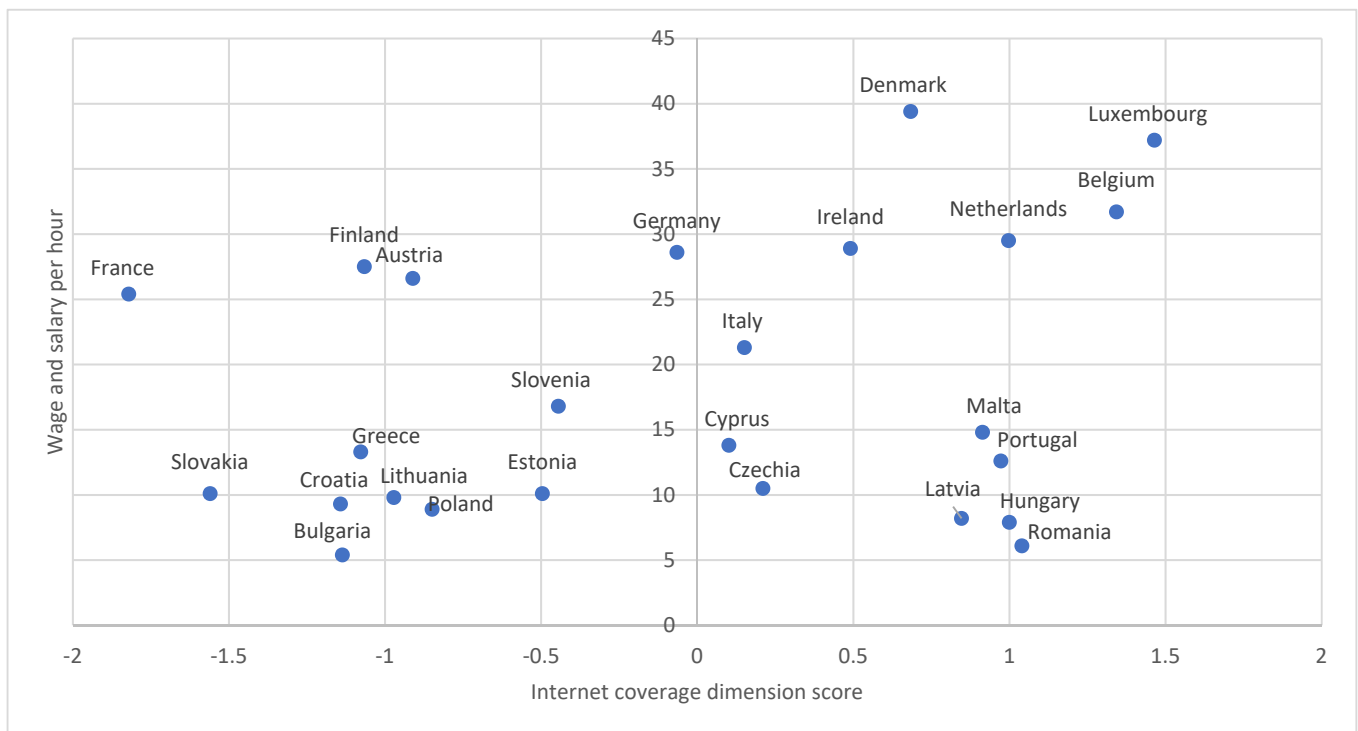


Figure 2. Internet coverage dimension and wages. Source: authors’ own calculations.

However, the results reveal a less significant correlation (Pearson coefficient = 0.252, $p = 0.205$) among EU member states between the Internet coverage dimension score and, respectively, salaries and wages. Still, the relationship between these variables allows for the identification of four clusters: member states with high salaries and high Internet coverage component score (such as Denmark, Luxembourg, Ireland, the Netherlands, or Belgium), member states with low salaries and low Internet coverage component score (such as Slovakia, Bulgaria, Croatia, Greece, Lithuania, or Poland); member states with high salaries and lower Internet coverage component score (such as France, Finland, or Austria); member states with low salaries and high Internet coverage component score (such as Hungary, Portugal, Romania, Malta, or Latvia).

Here, one should take into account the fact that the number of people connected to the Internet and the Internet coverage in a given country depends on a number of factors, among the most important being: the degree of implementation of the infrastructure (communications infrastructure, road infrastructure, electrical infrastructure), accessibility (device cost, service cost, electricity cost), relevance (access to content in the native language, perception of Internet use), skills in information technology, know-how, basic literacy, etc. [58].

The COVID-19 pandemic revealed that Internet coverage is very important and that in such situations the discrepancies between the richest and poorest areas of the world are even more noticeable. In line with the aforementioned observation, the International Labor Organization indicated that half of the workforce in high-income regions of the world,

such as North America and Western Europe, managed to work from home throughout the pandemic [40].

Even before the pandemic crisis, working from home via teleworking was in the attention of employers and employees alike. Employers saw this as an opportunity to reduce costs from renting and maintaining office space and employees saw it as beneficial because they could spend more time at home and the schedule became more flexible. This phenomenon was perceived as a natural step in rendering the labor market more flexible, so remote working was on an upward trend, but the growth was slight. The percentage of people that were working from home before the COVID-19 pandemic was only 9% in the EU member states [59].

Our results are, to some extent, consistent with similar empirical studies, which show that jobs involving activities that can be performed at home are better paid, and individuals who cannot work from home have a lower income [60]. Several surveys conducted in the first part of the pandemic period [61,62] showed that people who have the knowledge and means to work from home are more likely to keep their jobs and experience a smaller decline in income.

The ability to work from home is analyzed in several studies conducted after the start of the pandemic crisis [50,63–68]. These studies reveal a strong relationship between work digitalization and work from home ability. It is obvious that, in this context, high Internet coverage is mandatory for enabling working from home.

Analyzing who could work from home, taking into account the usage of the Internet, Gottlieb et al. [61] emphasize that the share of jobs being carried out remotely using the Internet during the pandemic varies considerably worldwide. The study of Gottlieb et al. [65] presents the share of 13.3% in Brazil, 20% in Romania, and up to 50% in Luxembourg. Then again, there is substantial heterogeneity across the share of remote occupations that can be performed remotely, ranging from 23% for managers to up to 41% for professionals, and only 1% for craft workers. Other studies present different figures. Sanchez et al. show that globally, one in five jobs are suitable for work from home. However, these figures are not maintained in low-income countries, where the ratio falls to 1 in 26 jobs [69]. To survive the pandemic and then to remain socially engaged through work, humanity accepted restrictions which forced employers to adapt to a technology-intensive operational model. These digital accelerated transformations came over the general background of already existing pressure towards the demise of classic work.

The restrictions implemented since March 2020 have involved a lack of physical contact and social distancing, hence the inevitable increased in innovative technologic activities instead of traditional market processes. Companies needed to implement changes to become more intensely digitalized entities. Restrictions affected the general workforce, management, decision-makers, etc.

5. Conclusions

Even pre-digitalization, the labor market was facing a series of issues such as low pay, poor work-related security, long hours of work or “out of hours working”, stress associated with physical and mental illness, and a lack of motivation or long-time unemployment. Apparently, technology deepens the aforementioned worries and issues, instead of lowering them. Digitalization will certainly reduce the workload, but it would be an even greater benefit if this came along with a more even distribution of work-related problems. Reduced average working time by inclusion of the unemployed should be a standard goal for digitalization. Either way, the general claim is that a future with less work is ahead. Throughout history, people have related to work in the same manner, regardless of the evolution of technical progress, but there are arguments to sustain that digital revolution would bring along major disruption in the process.

Lately, we notice that not only the COVID-19 pandemic but everything that has meant progress has brought us steps closer to digitalization, robots, and artificial intelligence; these elements will have a heavy influence upon the traits of the labor market future-wise.

The resulting environment is one whose definite feature is the uncertainty about the exact evolution of the main components of the economic milieu. The pandemic has created stimuli to induce profound changes in the labor market, changes that might be permanent. There are still many unknown variables in the frame of the COVID-19 pandemic, but what we may ascertain is that the workforce and human resource ought to possess the necessary skills to rapidly adapt to change. Those that cannot adapt fast enough, those who cannot work remotely, or those without a college degree are also the ones with low incomes. The ones who cannot adapt and change, the ones who cannot work remotely are mainly without a college degree; they have a low income, no Internet access, and become the vulnerable category of population [70]. The only certainty is that tomorrow's employees will need to have technical skills and digital skills, complemented by flexibility in thinking and problem-solving skills. In a few years' time, from store salesman to sales manager, from farmer to factory worker, everyone's work will be supported by robots, software applications, and artificial intelligence. These results speak to the importance of enhanced digital skills and extensive Internet access in retaining a well-paid job.

Our research further shows the importance of the digital proficiency, as this along with the Internet usage have direct implications on wages and salaries among the EU-27 member states. That is why it is important for decision makers to be aware that they should implement effective policies in education to increase digital skills. Additionally, our study shows that, in terms of the relationship between the Internet coverage and salaries, there is a clustering tendency, which raises alarming awareness in the matter of regional disparities that arise from this perspective.

The present study lacks insights into the psycho-sociological implications in the current pandemic context and data stops in 2020, unable to take into account the entire pandemic crisis which is still in progress. However, the obtained results can be the starting point for research post pandemic period, when more accurate statistical data is available. In addition, since the current study considers a single feature of the labor market (wages and salaries) and a limited series of digitalization status indicators, forthcoming research focusing on other components of the labor market (such as employment) and digitalization should add a more in-depth perspective on the topic.

It has been argued that digitalization mainly targets the quality of work; the truth is that, even more so than in the 2000s, new digital technologies render the workforce more expandable, more insecure, and having less leverage on the employers. Nonetheless, progress and technology are inevitable and, henceforth, they are not the faulty issue, but rather the social and economic policies sustaining the essence of capitalism, which is profit making. If we use technology to lower costs, and to enhance profit making, any perceived burdens will be reduced and labor income will presumably rise.

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on monthly wages and salaries is provided by National Institute of Statistics and is available at <https://insse.ro/cms/en/content/earnings-1991-monthly-series> (accessed on 23 July 2021).

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