Chapter 22
Digital Divide and Employment: From Job Disruption to Reskilling Workers for the Future World of Work

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Abstract Digitization profoundly changes the world of work and redefines it. Digitization at the workplace is a reality of the last decade, and the pandemic accelerated the pace of employment reform, causing greater flexibility of the active life model, but also increased vulnerabilities. Digitization statistics capture, through new indicators developed by Eurostat, the incidence of information and communications technology (ICT) services and products on jobs – skills, work intensity, risks, tasks and responsibilities, working conditions, remuneration, and professional career. Starting from the digital intensity in companies and the adaptation of the workforce in the pandemic, we analyzed the gaps between EU countries and companies' size. We highlighted the companies' digital reform status in the pre-pandemic and the changes made during the pandemic on the labor force, in order to outline the employment model and the content of jobs, as directions for the continuation of the post-pandemic digital transformation. The results obtained indicate significant and growing gaps between countries regarding the dynamics of changes and the achievement of expected results, as well as the different degree of readiness of the business environment and of individuals to respond to the challenges of the irreversible digital transformation of work, to strengthen the new post-pandemic employment model. Also, the results confirm that the concerns for digital performance, as a resilience factor of the company during the pandemic, were a priority not only for large companies but also for SMEs, including those that had a low level of digital intensity and from the lower-performing countries. As the pattern of changes, companies, during the pandemic period, had as their main orientation the adaptation through digitalization to the limitations of the measures for carrying out the activities imposed by COVID-19, with a preponderance on ensuring the skills for their own employees and less for increasing the share of employees with ICT specialization, which indicates that the adjustments were minimal and aimed at ensuring the conditions for remote work. The speed of digital evolution was facilitated by the level of economic development expressed by gross domestic product

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(GDP)/capita in PPS and the level of digital reform before the pandemic as strong advantages for building post-pandemic economic resilience. Based on the results obtained, recommendations were made for policy measures at company level to ensure a resilient employment model and close the performance gaps in the digital transition of work.

Keywords Digital intensity · Employment · Post-pandemic resilience

22.1 Introduction

The implications of remote work are not only on the model of communication and interaction with the employer but also on the management of work in different locations – the household becoming a workplace, business travel, working outside the classic 8-h work schedule in the first part of the day, etc. – which means adequate facilities for digitized work, associated costs, externalities on family life, work-life balance, etc.

The world of work is changing: (a) from job destruction and the need for workforce reskilling to the emergence of new professions and the need for transversal skills ("soft" skills); (b) from predominantly permanent and full-time jobs, to a reconfiguration of employment models centered on human needs and not exclusively on production and monetary profit (i.e. the expansion of flexible, atypical jobs that meet the objectives of sustainable economic development and resilience), but which also induce adverse effects such as vulnerability in employment; (c) from one single job and a well-defined career throughout the working life to multiple jobs, with increased instability and unpredictability in workers' career paths. Diversification of forms of employment and change of jobs attract insecurity and irregularity of earnings throughout working life; (d) new forms of labor market segmentation emerge, associated with digitization, with specific measures and policies for digital divide, digital disruption, and digital inclusion; (e) the motivation to enter and stay on the labor market is changing. In fact, it is the paradigm shift regarding how and where we work and, subsidiarily, the emergence of new, atypical activities and jobs where work motivation and associated professional career models are much more attractive to young people.

Although there are numerous studies that analyze the labor market, in its various aspects, in association with the digital transformation or the digital economy, which can provide us with the main directions and components that change the pattern of employment and the pattern of work in general, we have not identified studies that address the impact of digitization starting from the indicators newly calculated by Eurostat, at individual and enterprise level (Eurostat, Internet use at work/in enterprises).

In this chapter, we start from the analysis of the specialized literature by highlighting the interest for the multidimensional analysis of the changes on the labor market generated by digitization; then we move on to the statistical analysis of the indicators that reflect new aspects of the incidence of digital transformation at the individual

and the company level, with the presentation of the comparative situation between EU member countries. The "Results and Comments" section will also highlight the policy response through medium- and long-term measures to redefine the human capital development strategy and the management of its use on the labor market.

22.2 Literature Review

The changes in society generated by digital technologies extend to everyone, from companies and individuals/households to public institutions and other categories of market agents. The digital transformation of companies (technologies assisted by intelligent organizational coordination systems, as well as of the managerial processes in general), also requires the digitization of jobs as such and digital skills for the workforce. Moreover, the digital transformation of technological/managerial processes changes the requirements and conditions of exercising professions, and digital tools are redefining the fundamentals of activities associated with specific professional activities. Therefore, any company that digitizes itself from the perspective of the object of activity and the products and services made for clients must also consider the investment in the adequacy of its own workforce, but not only through knowledge and skills (which become a component of work supply, as a product of education and previous experience) but also through forms of employment, working conditions, and work organization (as factors for productivity and for individual and team performance).

The impact of the digital economy on the transformation of work at the company level can be found on at least four levels and requires the acceptance of three stages of company transformation. Starting from Kim et al.'s [16] concept of digital economy transformation at the firm level, we developed a model of the influence of work transformation at the firm level, differentiated according to working conditions, work organization, work performance, and reward/payment of work (Table 22.1).

The effects of digitization adjust both labor market mechanisms and the labor force at the firm level, at least from two perspectives:

(a) From the labor market side, several effects are already visible and can be listed as follows: the work content is redefined, the forms of employment and contractual relations are more vulnerable, and the fundamentals of the quality of the job are changing. At the same time, the mechanisms that influence labor market segmentation are fundamentally changing, both from the perspective of labor force categories and the impact on economic and social inclusion. The forms of segmentation are varied, from the classic segmentation of professions/jobs to more recent forms related to the effects of pandemic restrictions or digital inclusion. The specialized literature [22] analyzes the asymmetric effects on the labor market of the COVID-19 crisis – essential professions vs non-essential professions, but also the digital transformation of post-pandemic jobs. The

Table 22.1 The impact of the digital economy on work at the company level

Components of work at the firm level	Digital transformation at firm level [16]		
	Digitization – late 1960s	Digitalization (after 1994)	Digital transformation (after 2010)
Working conditions	Computer skills	Mobility-interconnectivity (digital skills and Internet skills)	Hybrid work; communication platforms (Zoom, Skype, Google Meet); high-quality digital infrastructure
Work organization	Improving efficiency, structural optimization of job duties, saving time for the work tasks	Shifting from routine work to non-routine cognitive work, digital work ecosystem	Technology-oriented jobs, goal-based work
Work performance	Work productivity increases	The added value in work is measured – quantity, quality, and efficiency; the costs associated with work are optimized	The professional performances are optimized; solving problems, holistic approach
Reward/payment of work	On results/outcomes, Taylorist model	Job performance task solving and decision optimization	Salary and non-salary benefits package

Source: Author contribution based on specialized literature

segmentation of the labor market according to these two attributes not only deepens discrimination – on multiple criteria – but also reconfigures the demand for labor and skills, profoundly changing the need for professional training and soft skills.

(b) The digital transformation and the incorporation of new technologies in the business environment substantially change the model of the use of labor force, the emphasis is on human capital, and the intangible components of the labor factor become predominant [7], from at least the following perspectives:

- The share of routine work decreases significantly; it is replaced by digitization or automation processes, the workforce moving from executing operations to supervision, monitoring, or database processing with the help of programs developed as ICT applications. In this case, a number of jobs disappear and are replaced by those of monitoring, supervision, etc. Lately, in such workplaces, the contribution of artificial intelligence for decision-making optimization is increasing, and management systems suitable for these activities are being developed [4–6] – for example, systems of total quality management (TQM) control, or Lean Six Sigma-type methods [3, 25], communication platforms with beneficiaries/customers, automatic control systems of processing processes, etc.
- Increases the share of creative activities/jobs, in which the role of human capital is to use knowledge and skills to carry out activities based on initiative, responsibility, innovation, problem solving, etc. The work content of these jobs is enriched with specific components of digital transformation, requiring permanent investments in support technology from the sphere of information and communications technology (ICT) products and services [12].
- There are new jobs specific to the digital economy in the ICT sector, or which provide digital support for the modernization of logistics processes in companies or public or private authorities, database processing, etc. [23] – system administrator, administrator network operators, data security specialists, big data operators, etc.
- Increases the dynamics of job renewal, based on problem solving and decision optimization, by combining artificial intelligence, multiple querying of databases, and multi-attribute communication.

In recent years, the digital transformation has focused especially on the development of the digital infrastructure of companies and on the digitization of the business' components. Only during the pandemic, was redefined the importance of the remote work. So, it was also reconsidered the importance of the hybrid work, mainly as way of adapting to the employers' requirements, respectively of continuing the activity under conditions of business profitability and efficient use of the labour force. While the efficient use of human capital has become the most significant factor in achieving the goals of the sustainable development strategy and business competitiveness, the deep reform of the labor market is still a topic of relatively peripheral analysis. However, in this context, on the contrary, the discourse of specialists on topics like skills mismatch or digital disruption on the labor market

is increasingly present in studies and analysis reports. Similar, if we refer to the digital and green transition, the issue of the new design of workplaces is more frequently addressed in integrated policies, at least at firm level.

These arguments support the analysis approach that I have selected and further developed, accepting the risk of missing consistent data series in terms of number of observations and time period, but having the advantage of highlighting new aspects of the impact of digitization on the dynamics of the world of work.

22.3 Methodology

In the analysis approach, we started from the premise that the database developed in the last two decades captures only the ICT sector component [24], but nowadays, the digital transition means much more. The digital economy mainly tracked digital products and services – technologies, infrastructure, and data [21]. The European Commission in 2014 stated that the main factors of the digital economy are mobility, network effects, and the use of data, marginalizing the value of human resources and intellectual capital as the driving force of a fully efficient digital economy [8, 14].

The digital economy statistics started from indicators of the ICT sector (indicating only the workforce employed in the sector) and, later, also included digital skills (as a significant statistical variable); recently, it has expanded to users (companies and individuals/households), developing indicators to measure the state of the digital transition in companies and households through effect indicators – the degree of use of digital components, digital intensity, etc. (Eurostat database) or OECD/national-level indicators [17, 21], including input-output tables [1]. In parallel, composite indicators were also developed that highlighted the countries' performances and, implicitly, the gaps in the digital transformation – the digital economy and society index (DESI), ranking digital rights index (RDR) index, digital diplomacy index (DDI), etc. The limit of these indicators is the reporting period, but their informational value provides an important supplement for specialists and especially for decision-makers to substantiate the updating of strategies for the "new normal" of development that we are going through starting from 2022. The pandemic, specifically the years 2020–2021, accelerated the dynamics of the digital transition and/or repositioned the importance of some components in the medium- and long-term approach to sustainable development and resilience of society and the digital economy.

The analysis methods used aim to identify whether the progress in the digital transformation measured by DESI correlates with the level of development of the states (GDP/capita at purchasing power standards (PPS)) or with the performance in education (the average number of years of school), or rather depend on other factors associated with the digital transition of companies (i.e. as a strategic objective for future competitiveness, or related with the limitations imposed by the pandemic).

We chose the digital intensity, an indicator that highlights the situation at the micro level, more precisely of businesses (aside from the financial sector), with 10 or

more employees, and self-employed, as well as indicators of the impact of the Covid-19 crisis on the use of ICT (taking into account the fact that starting from 2020 some of the companies' staff worked from home, having remote access via the Internet).

The research questions are as follows:

H1: Is there a correlation and what is the intensity of the connection between DESI dynamics during the pandemic and the level of development expressed by GDP/capita in PPS and/or performance in education (measured by the average number of years of schooling)?

H2: Is digital intensity in companies significantly influenced by the individuals' skills compatibility with duties and by the use of ICT at work?

H3: Is digital intensity significantly influenced by companies that provide training for developing/upgrading ICT skills of their personnel and by the share of enterprises that employ ICT specialists?

H4: During the pandemic, have the gaps between countries increased from the perspective of digital transition?

22.4 Results and Comments

22.4.1 Statistical Analysis of Selected Indicators and Informational Value for the Purpose of the Analysis

The pandemic crisis has shown that digitization is an important tool for improving the economic resilience of businesses. Investments in ICT and the employment of specialized personnel, including those with the necessary digital skills, represent the vectors of the digital transformation of the business environment, both on the production/services and sales components and also on the operational management, communication relationships, and specific activities (within the company but also with the tax institutions, the banking system, etc.).

The specialized literature and EU reports have highlighted that the pandemic has accelerated the digital transition by at least 5 years both in the segment of individuals and households and for the business environment – companies, banking system, tax authorities, etc. Other experts appreciate that the digital transformation has been interrupted, in the sense that in 2020 and 2021, only forced digital adaptation measures to the pandemic restrictions were operated, and then, with the removal of the restrictions, it returns to the previous state. An investigation carried out in November 2020, "McKinsey Global Survey of executives," [20] indicates (a) the acceleration of digitization at the company level, on the supply flow, by about 3–4 years; online trading platforms and customer communication have developed significantly; (b) the dynamics of technological renewal; that is, the share of digital or digitally activated products in their portfolios has increased/progressed by 7–10 years; (c) the dynamics of adaptation to remote work increased more than

40 times; (d) changes such as remote interaction with customers required investments in data security, which definitively removed some of the pre-crisis blockages to virtual interactions, so it is estimated that they will be maintained post-pandemic (i.e., changes in technology, along with remote working and customer interactions). About one-fourth of the respondents in the mentioned study indicate a decrease in their physical footprints; (e) the change in managers' mentality regarding the benefits of technological innovation associated with digitization, from the simple reduction of costs (which represents the main motivation before the pandemic, in 2017, for approx. One-half of company managers) to maintaining competitiveness (approx. Two-thirds) or business reorganization by incorporating digital technologies (approx. One-fifth) [18].

Another similar study, carried out by Deloitte in 2020, states that digital disruption has facilitated innovation by reducing reluctance in digital transformation. The adaptability through innovation of the companies, associated with the assumption of a greater risk compared to the achievement of the expected results, has redefined the response behavior of the companies, the time and administrative barriers being overcome by both the company managers and the public authorities [15]. As an example, we only mention the reprioritization of investments toward the incorporation of digital technologies, the association of technological innovation with the digitization of production and marketing processes but also of managerial operations and communication between and within companies (with increased digital security), and the training/development of digital skills for own salary or legislative changes to facilitate the expansion of remote work, work from home.

Moreover, if at the household level access to ICT products and services has obviously increased during the pandemic, the same cannot be said at the company level:

(a) At the company level, a series of indicators associated with "forced digitization" have not changed significantly.

Of the EU member states, only six provided digital skills training to their own staff in the first year of the pandemic: Estonia, Lithuania, Malta, Austria, Poland, and Sweden. All these countries (with the exception of Austria) employed more ICT specialists in 2020 than before the pandemic, to which Belgium, France, Cyprus, Hungary, Romania, and Finland are added. In other countries, the values of the mentioned indicators decreased – Bulgaria, Denmark, Ireland, Greece, Luxembourg, and Portugal (Table 22.2).

The differences in behavior in the first year of the pandemic are strongly dependent on the severity of the restrictions, on the incidence of COVID-19 cases, and also on the degree of digitization existing in companies and their openness to remote work and the incorporation of ICT products/services in the activity of companies.

(b) The degree of involvement of individuals in remote work – systematic work from home and the use of ICT at work – is strongly differentiated by country, which shows the different degree of "preparation" for "forced digitalization from the pandemic."

Table 22.2 Companies that provided staff training or updated digital skills and hired ICT specialists in the first year of the pandemic (% of total companies)

	Companies that provided training for ICT skills to their employees		Companies that have hired ICT specialists	
TIME	2019	2020	2019	2020
EU27 (from 2020)	10	10	19	19
Belgium	18	18	28	30
Bulgaria	7	5	20	16
Czechia	11	11	20	18
Denmark	19	18	30	29
Germany	13	12	19	19
Estonia	9	10	15	17
Ireland	14	12	32	30
Greece	9	8	22	19
Spain	9	9	17	17
France	9	8	17	18
Croatia	11	11	19	19
Italy	8	8	16	13
Cyprus	12	12	23	25
Latvia	8	7	20	20
Lithuania	6	7	15	16
Luxembourg	16	13	25	22
Hungary	8	8	26	29
Malta	14	16	27	29
Netherlands	:	15	25	24
Austria	10	11	20	20
Poland	6	8	23	25
Portugal	11	10	21	20
Romania	4	4	10	16
Slovenia	11	11	18	17
Slovakia	9	9	18	17
Finland	15	15	26	28
Sweden	10	11	18	21

Source: Eurostat, enterprises that provided training to develop/upgrade ICT skills of their personnel [ISOC_SKE_ITTN2__custom_2990294]; enterprises that employ ICT specialists [ISOC_SKE_ITSPEN2__custom_2990257] (percent of enterprises in all enterprises, without the financial sector (ten or more employees and self-employed persons)

At the EU level, in 2018, only 4% of individuals currently worked from home, and 14% used the Internet when working from home, with large differences between countries (Table 22.3).

Therefore, there is a strong asymmetry of the states in the course of digitization, depending on the production structure and the performance of the business environment but also on the investments in the digital infrastructure and in the human resource capable of using ICT products/services. In 2018, only Malta and Finland

Table 22.3 Degree of readiness for accelerating digital transition at the company level, pre-pandemic (2018 data)

	A	B	C	D	E
EU27 (from 2020)	4	14	25	10	40
Belgium	5	17	26	11	44
Bulgaria	2	5	16	4	21
Czechia	:	:	35	7	43
Denmark	6	28	32	13	52
Germany	5	15	29	18	54
Estonia	6	22	27	13	48
Ireland	5	11	19	10	34
Greece	4	8	17	4	24
Spain	4	14	22	7	36
France	6	16	27	9	43
Croatia	3	8	20	6	30
Italy	3	9	21	6	33
Cyprus	2	5	27	7	36
Latvia	5	15	30	7	39
Lithuania	3	12	24	9	37
Luxembourg	8	19	29	13	47
Hungary	4	11	24	3	30
Malta	8	20	28	15	48
Netherlands	7	31	41	17	61
Austria	4	16	28	16	49
Poland	4	11	23	6	32
Portugal	4	11	24	8	37
Romania	1	4	11	4	18
Slovenia	6	15	29	7	40
Slovakia	4	13	27	6	35
Finland	8	25	31	10	50

Source: Eurostat, data retrieved on June 28, 2022

Note: No available data for Sweden; A = People who work from home daily or almost every day; B = People who use the Internet for work when they work from home; C = People's skills match well with duties related to the use of computers, software, or applications in the workplace; D = Individuals who have the skills to handle more demanding tasks related to the use of computers, software, or applications at work; E = Individuals who use computers, laptops, smartphones, tablets, other portable devices, or other computerized equipment or machines, such as those used in production lines, transportation, or other workplace services

had twice as many people working from home as usual, compared to the EU average of 4%, the lowest share being in Romania with 1% and Bulgaria with 2%.

Regarding the use of the Internet for activities associated with work at home, at the EU level, the share of people who used the Internet for work in 2018, when they worked from home, was 14%; in Romania, Cyprus, and Bulgaria, the proportion was 4–5%, and more than one-fourth was registered in the Netherlands, Finland, and Denmark.

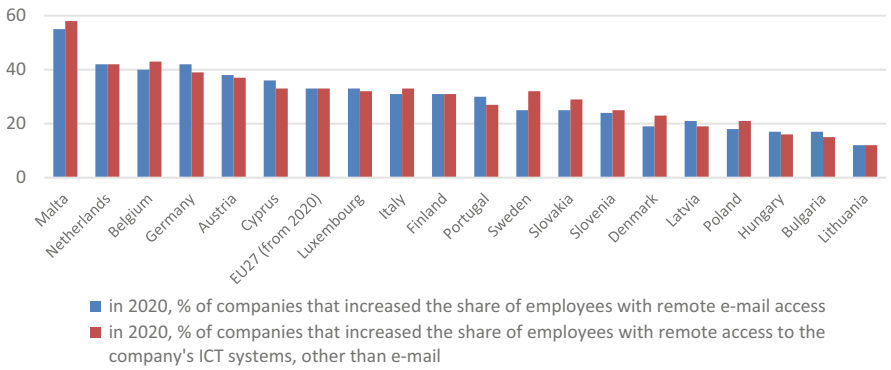

Fig. 22.1 Companies that hired staff to work from home, with access to the Internet or other company-specific systems, in 2020. (Source: Eurostat, Covid-19 Impact on ICT usage [ISOC_E_CVD__custom_3052934])
Note: the share of enterprises in total firms; no data available for Croatia, Czech Republic, Estonia, France, Greece, Ireland, Romania, and Spain

It is noteworthy that only 10% of firms, EU-wide, had the digital skills needed for more demanding tasks related to the use of computers, software, or applications at work, with a variation across countries between 18% in Germany and 3% in Hungary. The gap regarding the use of digital technology components for workplace activity was larger; the share of companies per country was between 61% in the Netherlands and 18% in Romania, with an EU27 average of 40%.

All these data indicate a poor performance in the digital transition for many EU27 states, which justifies different measures to adapt some activities during the pandemic, from temporarily closing the company or switching to remote work to accelerating investments in communication technology and digitized activities, including moving to/developing online commerce.

(c) The adaptation of companies to the conditions imposed by the pandemic crisis meant, not only in supplementary investing in equipment, but also in the hiring of ICT experts and in the training of their own employees, including the acquisition and/or updating of the digital skills necessary for work tasks' performance.

The impact of COVID-19 on the use of ICT in the enterprise, determined only at the level of 2020 and measured by the increase in the share of people employed to work from home, with access to email or other company-specific systems, indicates that on average at the EU27 level (as of 2020), two-thirds of companies have hired staff and expanded working from home (Fig. 22.1).

Once more, the results shows sizable disparities by country, which are influenced not only by the stage of the digital transition implementation at the company level but also by the field of activity, and by the structure of the business environment on sectors and activities.

(d) The digital transition during the pandemic did not only mean adapting to the pandemic restrictions but also the continuation of digitization strategies,

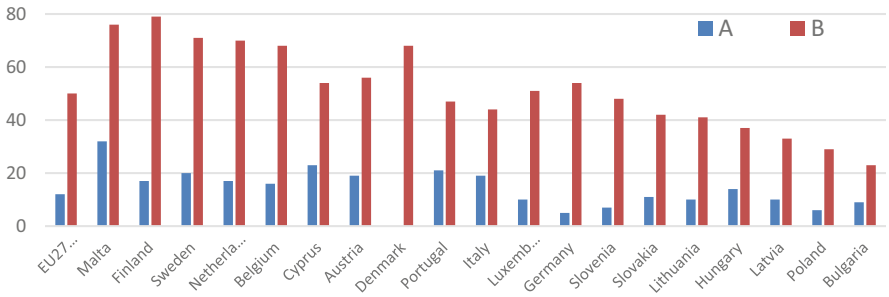

Fig. 22.2 Effects of the COVID restrictions in 2020 measured by: (**a**) the share of companies that have initiated measures to switch to the sale of products online or only to their development and (**b**) that have promoted remote meetings, via Skype, Zoom, MS Teams, etc

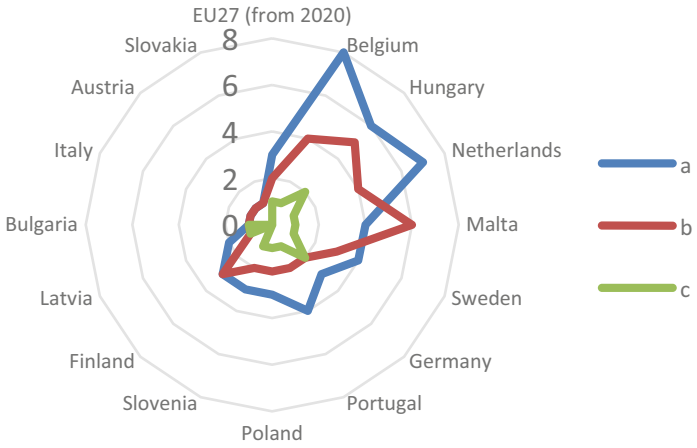

Fig. 22.3 Digitization measures in enterprises without being influenced by the measures imposed during the pandemic. (Source: Based on Eurostat data, Covid-19 Impact on ICT usage [ISOC_E_CVD__custom_3052934])
Note: a = % enterprises with an increase in remote access to the enterprise email system that was not at all due to the Covid-19 pandemic; b = % enterprises with an increase in the percentage of employees who have remote access to enterprise ICT systems other than email that was not at all due to the Covid-19 pandemic; c = % enterprises with an increase in the number of remote meetings held by the enterprise that was not at all due to the Covid-19 pandemic

companies being concerned with the continuation of their own digital reform programs.

In this sense, it should be noted that the companies also promoted digitization measures that are not related to the pandemic crisis (Figs. 22.2 and 22.3). It is found that although the priority was for rapid adaptation to pandemic restrictions, the continuation of the digital transition reform in companies was more intense in

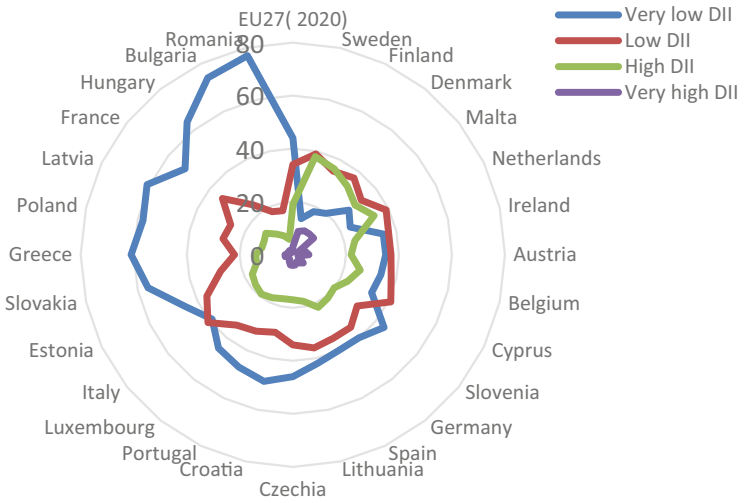

Fig. 22.4 Digital intensity in 2020, by country. (Source: Eurostat data, Digital Intensity [ISOC_E_DII__custom_3052501])

Belgium, Hungary, the Netherlands, and Malta and statistically insignificant in Denmark, Cyprus, Lithuania, and Luxembourg.

Once again, a strong behavioral asymmetry is found across countries and types of measures, with Belgium, Hungary, the Netherlands, and Malta standing out due to the proportion of companies that continued the digital reform, beyond the need to manage the limitations imposed by the pandemic.

Last but not least, a new indicator created by Eurostat emphasizes the digital intensity of companies[1] measured by the structure of companies according to the degree of digitalization, from extremely low/minimal to very high. The available data, only for the year 2020, show us, on average, that 44% of companies have a very low level of digital intensity, one-third have a low level, about one-fifth a high level, and only 3% a very high level (Fig. 22.4).

The differences are significant both according to the size of the company and also according to the fields of activity. A high level of digital intensity is found in large companies (approx. One-fifth) and in the ICT and accommodation services (approx. 10%) branches. The lowest level is found in small firms and in transport, storage, and construction activities. The differences by country are equally significant, with Romania being at an extreme, having the highest share of companies with a very low level of digital intensity (77%) and only 1% of companies with a very high

[1] According to Eurostat, the Digital Intensity Index (DII) is a composite indicator calculated on the basis of data from two surveys, namely, the ICT Use Survey and the Enterprise E-Commerce Survey. It takes into account 12 variables and distinguishes four levels of digital intensity – for details, see https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20211029-1

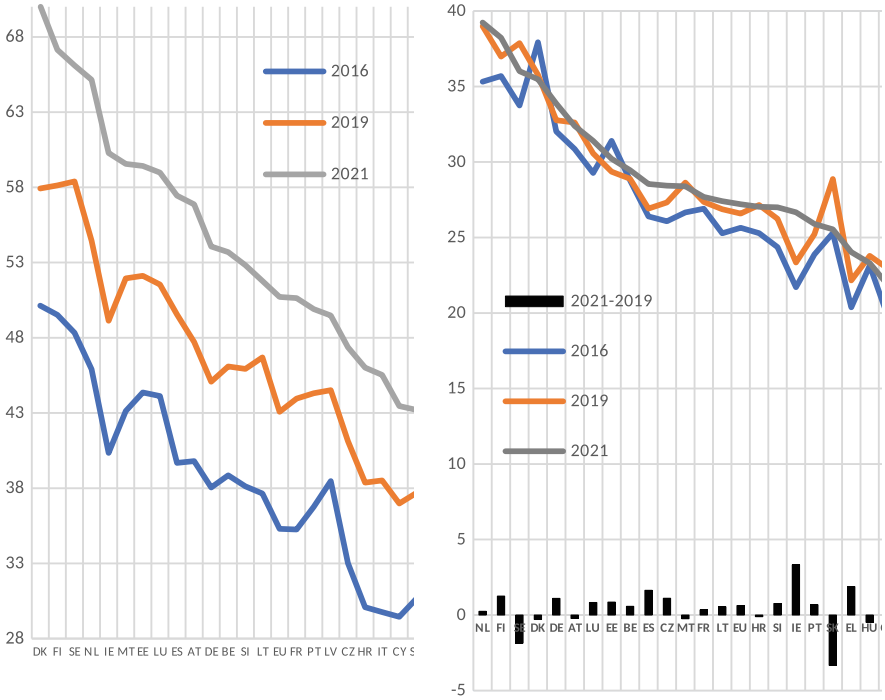

Fig. 22.5 The evolution of the total DESI and the human capital component in the pandemic and the change in the gaps between countries. (Source: Data available at https://digital-agenda-data.eu/datasets/desi/visualizations)

digital intensity and Sweden with a 47% share of companies with high and very high digital intensity. The gaps by country according to the four categories of digital intensity are 63 percentage points for very low, 24 p.p. for low, 32 p.p. for high, and 9 p.p. for very high.

From the analysis of the indicators that reflect the dynamics of the digital transition, the DESI index could not be omitted. Considering the purpose of the analysis in this study, we selected for analysis only those components of DESI directly related to the digitization of the labor market.

Since we only have comparable data from 2016, and the result of the pandemic can be better observed through DESI component indicators, we will now present, on the one hand, the comparative analysis of the evolution and differences by country of the total index and the subcomponent human capital and, on the other hand, how the states reacted in the pandemic, from the perspective of employee training and digital infrastructure development.

From the perspective of the human capital component, it can be seen that the differences by country are about three times, with two poorly performing countries, namely, Romania and Bulgaria, and with 14 countries with performances above the EU27 average, the Netherlands and Finland holding the first places (Fig. 22.5).

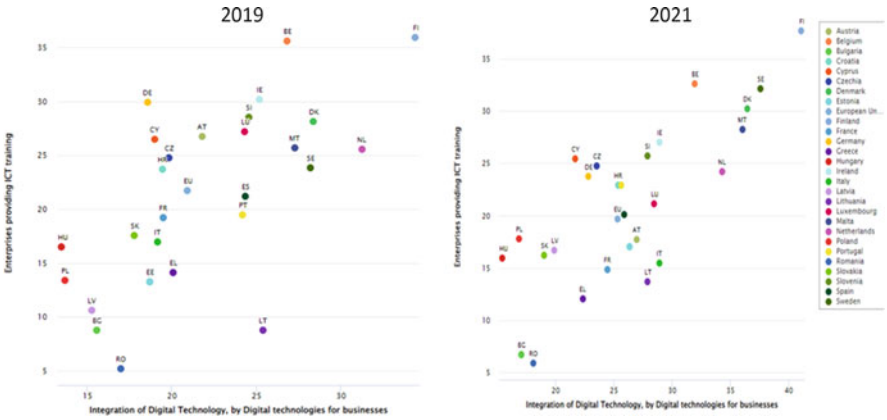

Fig. 22.6 The integration of digital technologies for business in companies and training courses for ICT skills – indicators from the DESI component in the years 2019 and 2021. (Source: EC-Digital Scoreboard, digital-agenda-data.eu)

If, on the EU27 average, the human capital sub-indicator in 2021 had values above those of 2019, we cannot say the same for 11 of the member countries.

The integration of digital technologies requires increasing the effort of companies to train/improve their workforce. For companies, the two years of the pandemic meant the intensification of the introduction of digital technologies and the training of staff for the use of those technologies (Fig. 22.6).

Concerns for digital performance, as a resilience factor of the company during the pandemic, were a priority not only for large companies but also for small and medium-sized enterprises (SMEs), including those that had a low level of digital intensity. According to the EC-Digital Scoreboard, the progress recorded in 2021 compared to 2019 was more intense in the lower-performing countries, which also confirms in this way that the pandemic restrictions have accelerated the digitization of companies (Fig. 22.7).

22.4.2 Research Hypothesis Results and Comments

Dependence of Economic Development on Digital Performance

The average number of years spent in school, which is used to express education level, has a minor impact on The Digital Economy and Society Index (DESI) evolution; it only accounts for roughly 0.1 of the relationship between the indicators. By this, we can conclude that the digitization measures taken during the pandemic targeted basic digital skills, accessible to the population and employees relatively easily, through minimal training, the training provided by companies for the transition to remote work, and the use of ICT products and services being the most common. Digital evolution is facilitated by the level of economic development

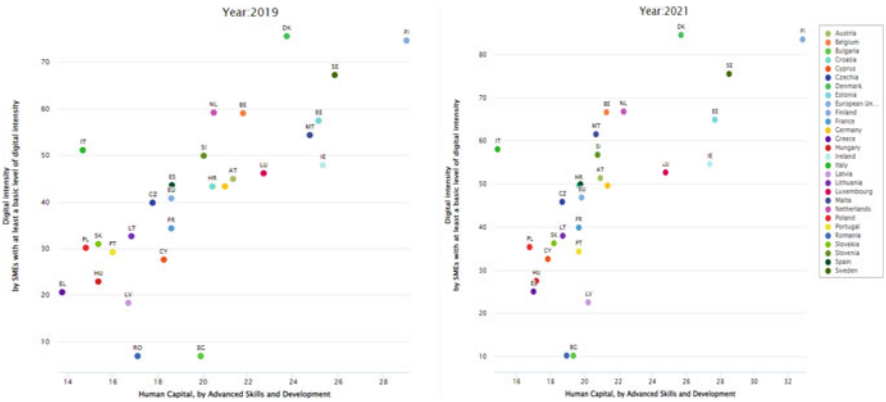

Fig. 22.7 Human capital (with advanced digital skills) and digital intensity of SMEs with at least a basic level of digital intensity, in EU member countries, in 2021 and 2019. (Source: EC-Digital Scoreboard, digital-agenda-data.eu)

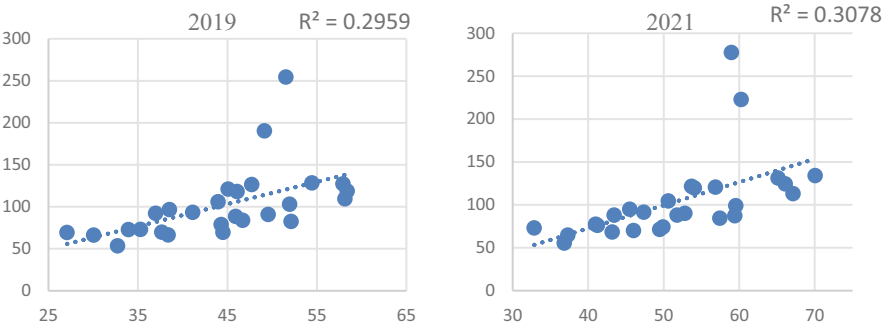

Fig. 22.8 DESI and GDP/capita in 2019 and 2021. (Source: Based on the DESI database and Eurostat)
Note: ox = GDP/capita and oy = DESI

expressed by GDP/capita in PPS. During the pandemic, digital transformation advanced in all countries, as we have already highlighted, mainly on the side of adapting economic activities and customer relations to the limitations imposed by the pandemic, but differently by country, the level of digital development before the pandemic being an advantage for building economic resilience during the COVID-19 crisis. The link between the two variables intensifies in 2021 compared to 2019, and the countries with a significant advance in digital transformation were Denmark, Ireland, and the Netherlands (Fig. 22.8).

Through these results, we can appreciate that the research hypothesis H1 was partially validated, the DESI index being influenced, in the short term, by the level of economic development expressed by GDP/capita in PPS in a proportion of about one-third.

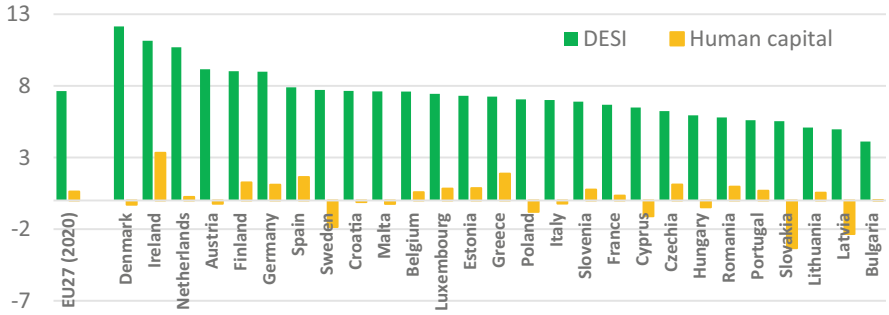

Fig. 22.9 Change in DESI and human capital component in 2021 compared to 2019. (Source: Based on data from https://digital-agenda-data.eu/datasets/desi/visualizations)

The gaps by country from the perspective of the digital transition evolved differently on the DESI component indicators. Overall, on the total DESI index, all countries recorded progress in the pandemic (in 2021 compared to 2019). As for the Human Capital pillar the gaps between EU countries increased very little on total, due to the reduction in the digitization performance of human capital in 11 countries. Therefore, the partial conclusion that digitization during the pandemic was mainly about adaptation is confirmed, with the mention that each country, depending on the previous progress in the digitization of human capital, focused on other elements of digital development (Fig. 22.9).

If in 2019 the best performance in the general DESI indicator was held by Sweden and the weakest by Romania, in 2021, Denmark takes first place, the country that also recorded the highest growth during the pandemic, and the last place remains unchanged. Regarding the human capital component within DESI, both in 2019 and 2021, the best performance is recorded by the Netherlands, and the weakest is held in 2021 by Bulgaria; Romania, ranked last in 2019, is ahead of Bulgaria during the pandemic. Based on the above, we can conclude that hypothesis H4 has been validated.

Digitization at the Company Level During the Pandemic

The digital development of companies was considered as the safety valve for the pandemic period and the sole alternative option to the temporary closure of the activity. For some categories of activities (such as, for example, personal services) the measures to limit the risk of infection were very restrictive, i.e. closure during the lock down period or their fundamental reorganization, by switching, at least temporarily, to a system totally online, (e.g. fitness activities, psychological counseling, etc.). In other activities, it was possible to continue the activity by intensifying the digitalization of the company and innovation in customer relations (restaurants switched to the take-away or home delivery system, supermarkets also partially adopted such services, etc.).

Starting from the premise that digital intensity at the company level means both investments in ICT technology and staff training, we analyzed other two aspects:

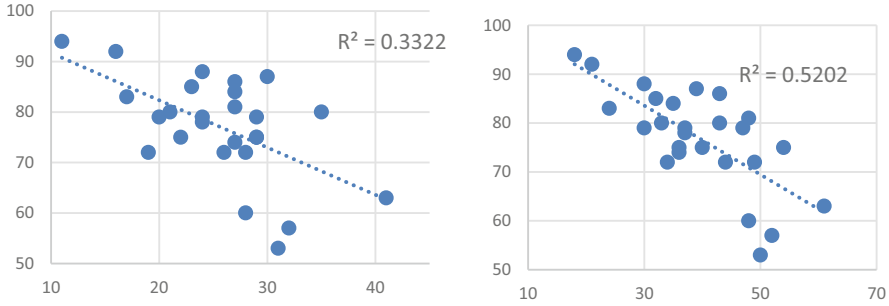

Fig. 22.10 Analysis of the company's digital intensity in correlation with individuals' skills compatibility with duties (**a**) and individuals' use of ICT at work (**b**). (Source: Based on the Eurostat database)

hypotheses H2 and H3. The analysis is only possible at the level of 2020, with no data for a longer period in the Eurostat database and only for a limited number of EU member states, for which data have been reported. In both situations, we took into account the share of companies that have a minimal digital intensity (very low) because we considered that the pandemic affected all companies, and the most vulnerable and also the most numerous were those with reduced digital intensity.

For H2 (the extent to which the level of digital intensity depends on the compatibility of employees" digital skills with the requirements of the workplace and the degree of use of ICT products and services for work) the data analysis only shows us a bilateral dependence on the two components. The multiple regression analysis does not give us relevant data, and in our opinion the main limitation is the lack of data for several observations.

The data analysis only shows us a bilateral dependence on the two components; the multiple regression analysis does not give us relevant data, and in our opinion, the main limitation is the lack of data for several observations. The analysis through simple regressions shows us a separate dependence on the two variables with the digital intensity of the company of about one-third in the case of the compatibility of digital skills with the job demand and one-half in the case of the ICT use at the workplace (Fig. 22.10).

For H3 (the extent to which the digital intensity is significantly influenced by the share of companies that provide training for developing/updating the digital skills of employees and by the share of companies that employ ICT specialists) the results show us, as in the case of H2, only a bilateral dependence on the two components. The analysis based on multiple regression does not provide relevant data, similar due to lack of data for more observations. The results show us, as in the case of H2, only a bilateral dependence on the two components; the analysis based on multiple regression does not provide relevant data due to lack of data for more observations. The analysis through simple regressions shows us a separate dependence on the two variables with the digital intensity of the company of about two-thirds in the case of training own employees to acquire/increase digital skills and only one-fourth with the hiring of new ICT specialists in companies (Fig. 22.11).

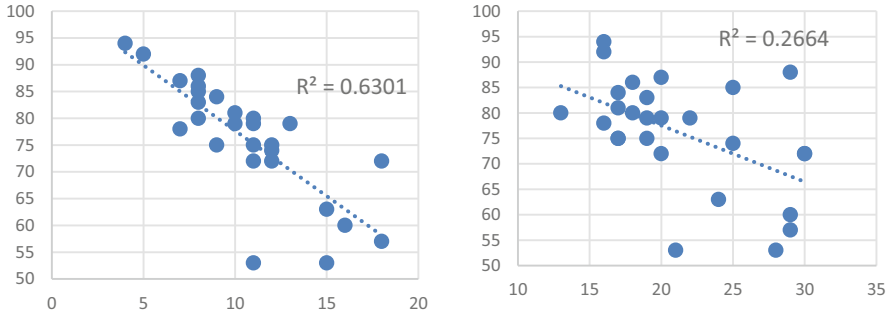

Fig. 22.11 Analysis of the company's digital intensity in correlation with the companies' effort to ensure training courses for their employees to develop/upgrade ICT skills (**a**) and with the share of companies that employ ICT specialists (**b**). (Source: Based on the Eurostat database)

The results of the analysis for hypotheses H2 and H3 confirm the fact that companies, during the pandemic period, had as their main orientation the adaptation through digitalization to the limitations of the measures for carrying out activities imposed by COVID-19, with a preponderance on ensuring the skills for their own employees and less for the increase in the share of employees with ICT specialization, which indicates that the adjustments to ICT development were minimal and targeted to ensure the conditions for remote work, facilitated by ICT technologies. The present analysis will resume after the data for the second year of the pandemic will be available, and we estimate that the intensity of the correlation will increase in the bilateral relationship. At the same time, it is also possible to obtain significant results for the application of multiple correlations, including for a larger number of states.

22.5 Conclusions

Digitization is changing the world of work. The factors stimulating work innovation and the barriers to optimizing professional performance become the challenges of social inclusion and efficiency policies on the labor market, both at the company level and at the national level. Digital transformation has been perceived by most as a form of progress, changing work and life patterns, expanding access to knowledge, developing new skills, redefining the work paradigm, and reconfiguring the structure and prioritization of workforce expectations in terms of active life and balance with personal life.

Digital technologies have already proven that they can be transformative forces of the workplace and industrial relations; they are an opportunity for inclusion on the labor market and to reduce imbalances, but they require computer, digital, and connection skills (computer skills, digital skills, Internet skills) [11]. The disruptive

forces of digital transformation are changing the structure and pattern of employment, emphasizing multiple skills in the workplace and reducing physical workloads (digitization, automation, artificial intelligence (AI)). Workplace content and tasks, as well as criteria and methods for evaluating work productivity and performance, are radically changing [2, 9, 10, 13].

The digitized labor market appears as a post-pandemic normality and reforms the evaluation and remuneration mechanisms, making the labor market more flexible but also more vulnerable. The externalities of digitization on the labor market (both positive and negative) point us to the way to reform the employment model. Digitalization statistics capture, through new indicators, the incidence of ICT services and products on work – skills, work intensity, risks, tasks and responsibilities, working conditions, remuneration, and professional career.

In this chapter, we highlighted the gaps between the EU countries regarding the impact of digitization on the labor market, starting from the analysis of the specialized literature and some relatively recently developed Eurostat indicators on this topic. The results obtained indicate significant and growing gaps between countries regarding the dynamics of changes and the achievement of expected results, as well as the different degree of readiness of the business environment and of individuals to respond to the challenges of the irreversible digital transformation of work, to strengthen the new post-pandemic employment model.

Although the analysis carried out in the present study covers a short period of time and includes partial results regarding the impact of the pandemic on business environment reforms in the digital transition of human capital, a series of recommendations for measures for the post-pandemic period can be stated, in line with EU strategic approach [19], among which we mention:

- The impact of the pandemic makes it necessary to review digitization strategies at company level, capitalizing on the results of forced digital adaptation, in the activities where this is possible. It is obvious that it is not possible to completely return to the pre-pandemic situation and, for some activities, it would not even be effective.
- The pandemic has taught us that, in some cases, digitization reduces costs and saves time both for employees and for customers or other partners of companies, that it makes work easier, that employees have adapted to hybrid work, and that the pandemic itself stimulated the diversification and development of new products and services.
- The reform of the workplace toward decent and efficient work will continue; employees are more open to accepting digitization as a constant of the work content, regardless of the position held and the specific professional.
- The employment model is changing – from the forms of employment to the organization of working time, from the mix of skills required for hybrid work to the emergence of new jobs, as a result of digital disruption associated with the progress of manufacturing technologies or methods of work organization and firm-level management, where AI components assist and streamline both execution and coordination jobs, including top management.

– At the company level, there will be changes in the employment structure, and the requirements of the workplace will involve the continuous training of employees and the adequacy of knowledge and skills, both professional and soft skills, and even more so with digital ones. A solution to increase labor productivity in the short term is the reduction of skills asymmetry in employment through training provided by companies and, in the medium and long term, through better adaptation of the educational curriculum to the needs of the labor market.

We are aware of the limits of the research, but the results obtained managed to capture the gaps between countries and the associated future risks regarding the youth employment rate and their retention in the national labor market, the increase in work performance, and the limits of market competitiveness. Although the results are preliminary, through the information provided in the analysis, I believe that it justifies resuming the research over a longer period, depending on the availability of data. In addition, the present research brings additional arguments to the specialists' opinion according to which a new approach is needed in the analysis of the labor market performances and a reconsideration of some traditional indicators, such as labor productivity, employment risk, work pressure (the phenomenon of burnout, the right to disconnection, pay for performance, etc.), and gender inequality. Additionally, with the extension of database, of the time period, for the analyzed indicators, the reaserch should be resume and developed by highlighting at least: (a) the degree to which digitization improves or does not improve, in the medium and long term, the imbalances on the labor market as well as (b) how digital inclusion facilitates social inclusion through decent employment and support the professional career development.

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