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Abstract

The emergence and global spread of ICT have brought about a new socio-economic challenge of digital exclusion. Over time, this challenge has become a complex societal issue with direct economic repercussions in many areas. Specifically, this phenomenon is crucial from the labour market perspective, at both the macroeconomic and microeconomic levels. Due to the COVID-19 pandemic, online business and management activities have increased rapidly. These changes have highlighted the need to explore the problems of digital exclusion and/or the unsatisfactory digital skills of the labour force more deeply. Our paper aims to identify how digital exclusion is manifested in the Slovak labour market and highlight the tendencies that the COVID-19 pandemic has accentuated. In the analysis, we use available aggregate-level and individual data characterising the Slovak labour market from the macro-perspective, comparing it to the other EU Member States. To gain a more composite picture from the microeconomic perspective, we use original questionnaire survey data gained from medium-sized and large enterprises in Slovakia. According to our findings, the proportion of Internet non-users in the Slovak and European populations declined considerably during the pandemic. However, we identified a risk of the durability of digitally disadvantaged groups of the population among those who are at least 55 years old, those with a low education level, and people in financial distress. Our results underline the fact that companies could help their employees cultivate their digital literacy and resilience to enable a more inclusive digital society and a better-performing labour market in Slovakia.

Keywords

digital exclusion, digital divide, labour market, COVID-19 pandemic, Slovakia

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Introduction

During the last few decades, digitalisation and digitisation processes have rapidly influenced and shifted the economic systems. The structure of all their sub-systems, including the labour market, has been affected. Various jobs are changing (as an output of processes such as automation and digitalisation) and new practices are emerging. As a consequence, the requirements and competencies for numerous positions are evolving too. Not surprisingly, adaptation to these labour market structural changes is a complex process, and people differ in terms of the level of the digital skills they have achieved. They are different at the level of the technologies used (e-mail, social networks, mobile applications, etc.), but also at the level of knowing how online systems are organised, how problems in the digital area are structured, and how information is transformed into digital output (e.g. software skills), etc. Different forms of general or specific digital skills are no longer merely important, but are now central to the labour market. Additionally, according to Skvarciany and Jurevičienë (2021), the digital economy could not develop without the specific digital skills of humans. Thus, digital skills and their differences across the population are of central interest to job seekers, employees, employers, policymakers, and scholars.

One of the risks of digitalising economies is that it can become a source of increased inequalities and, eventually, an initiator of new forms of inequalities. These inequalities can occur at both the international and national levels. At the global level, differences among countries can occur due to different education systems and demographic transitions. At the national level, certain social groups are not able to adapt quickly to a changing labour market due to the lack of necessary digital skills; in these circumstances, one can talk about digital exclusion. Thus, policymakers are interested in identifying these groups by searching for their socio-economic characteristics, enabling the implementation of the appropriate policy measures. However, the distribution of digital skills in the population is not only interesting at the macroeconomic level. From a microeconomic perspective, companies as active entities in the labour market are also facing new challenges when preparing human resource management strategies (skill-up strategies, re-skill strategies, vacancy strategies, etc.) and business strategies.

The COVID-19 pandemic has led to a sudden and unprecedented rise in digital transformation. Many companies turned to remote work to limit the effect of the virus and foster modern forms of communication and systems of selling their products and services (such as e-shops). For the moment, there is only very limited empirical evidence of the effect of the COVID-19 pandemic on the distribution of digital skills and the problem of digital exclusion.

Our research perceives digital exclusion as a factor influencing current labour market developments in Slovakia. The aim is to identify how digital exclusion is manifested in the Slovak labour market and highlight the tendencies that the COVID-19 pandemic has accentuated. The novelty value of our research consists of the combination of approaches from both the macro- and micro-perspectives. At the macroeconomic level, we analyse data on digital skills and the unemployment rate in Slovakia, comparing it with five-year data from other EU Member States. We implement the microeconomic approach by analysing questionnaire survey data from medium-sized and large enterprises in Slovakia in 2021. We scrutinised the results obtained by both procedures to obtain our findings.

1. Literature review

Since the World Wide Web opened the Internet in 1991, its diffusion around the globe and across new services has been very rapid, and it has given rise to significant changes in everyday life. However, there are relevant differences in access and use across geographic areas and groups of individuals, which are called digital divides (Pérez-Amaral et al., 2021). The issue of the digital divide and digital inequality is a serious societal problem. At the outset of wider computer use, it seemed that the problem was largely basic technological and economic problems related to access to digital media; however, over time, it has become a broad-spectrum social problem that affects all domains and aspects of contemporary society. Antonelli (2003) defines the digital divide as the gap between the digital rich and the digital poor. The concept evolved from the dichotomous category of computer access (ICT user or ICT non-user) (DiMaggio and Hargittai, 2001) into a focus on skills which are necessary in the context of digital technologies and that recent approaches take a perspective on digital skills as key competencies (Lupač, 2018; Ertl et al., 2020). This development can be broken down into three levels of the digital divide. The first level was highly topical until 2010 and referred to gaps in access to computers. Later, following Internet diffusion, the term shifted to encompass gaps in not only computer access but also Internet access (van Deursen and van Dijk, 2011). Following that, both researchers and policymakers were convinced that it is the ability to use technologies and digital skills that distinguish one from the other and cause a problem as it contributes to the widening of inequalities (Aissaoui, 2021). This is the so-called second level. Since 2015, there has been a focus on the beneficial outcomes of using the Internet, which has been labelled the third-level digital divide.

It is possible to perceive that digital inequality is something of a precursor to digital exclusion, which refers to a kind of social exclusion caused by a lack of access to digital services (Edmunds, 2020). Digital exclusion involves the unequal access to and capacity to use information and communication technologies that are seen as essential in order to fully participate in society (Schejter et al., 2015). Research led by Śmiałowski and Ochnio (2019) has shown that digital exclusion affects every socio-economic group and every income group. People who are disadvantaged in the areas of economic, social, and personal well-being also tend to be least likely to engage with ICTs (Helsper and Reisdorf, 2017). This means that social exclusion leads to digital exclusion, leading to deeper inequalities and new social exclusion – the vicious digital cycle (Warren, 2007).

Studies of the first-level digital divide have shown that Internet access is unequally distributed among individuals with different demographic characteristics, such as age, gender, socioeconomic status, ethnicity and geography (Scheerder et al., 2017). Likewise, other important studies use mainly socio-economic variables such as age, education, gender, and income (Ono and Zavodny, 2007).

In the past, it rather seemed that income was the most important factor in this regard, followed by age and education (van Dijk, 2006); however, declining ICT prices have recently reduced the importance of income. Economic class remains a strong predictor of disparities throughout the digital inequality stack, including quality of hardware, software, network access, usage patterns, and skills (Robinson et al., 2020). Higher household incomes are strongly associated with broadband access, while very low-income households do not have broadband connections in their homes (Reddick et al., 2020). Employment status and earned income both predict the intensity of computer usage, as well as online activity footprints (Witte and Mannon, 2010). As income increases, the scale of digital exclusion decreases (Śmiałowski and Ochnio, 2019).

In terms of age, younger individuals have, on average, higher levels of digital skills than older individuals. At the same time, Internet use is strongly skewed in the 65+ age group, leading to a partial exclusion of older seniors (70+) (Friemel, 2016). On the other hand, individuals over the age of 60 are a highly heterogeneous group with different education, income levels, work experience, skills, and other factors that also impact digital skill levels (Hargittai et al., 2019).

The socio-economic variable of gender was a significant factor influencing the level of digital skills at the advent of ICT, but at present, its influence has significantly weakened (Ono and Zavodny, 2002). In some countries, gender-related results have reversed, and women have better Internet access and associated digital skills. The opposite conclusion is reached in a study by Acilar and Sæbø (2021), who perceived that – despite a significant increase in usage of the Internet and other ICTs around the world – women, especially in developing countries, tend to be on the wrong side of the digital divide. As a result, it remains a variable whose influence should be regularly examined (Scheerder et al., 2017). Finally, the research factor that can be considered the most consistent variable is the level of education achieved; in general, there is a correlation between Internet access and the level of education attained, and the highest levels of penetration are found among the most educated (Chaudhuri et al., 2005). Education is also a strong complement to the Internet, and the relevant educational levels are the secondary and tertiary levels, as they are expected to upgrade the national capacity for adaptation and innovation (Quibria et al., 2003).

In 2001, the OECD identified an urban-rural digital divide at the international level that was framed by cost and quality of access and related network costs and infrastructure capabilities (Philip et al., 2017). Rural communities have been struggling to keep up with developments in digital connectivity (Malecki, 2003). The Internet offers the rural citizen significant benefits, helping to overcome the disadvantages of distance and social dispersion (Warren, 2007). On the other hand, rural areas are at a digital disadvantage due to their lower levels of Internet and broadband connectivity.

The COVID-19 pandemic has revealed deep-seated inequalities across different societies, from the most advanced economies to the economically underdeveloped (Zheng and Walsham, 2021). COVID-19 has exposed the digital divide like never before and has made it a burning issue (Aissaoui, 2021). Since the arrival of COVID-19, several studies have emerged that provide interesting findings (Meyer et al., 2022).

The COVID-19 pandemic has accelerated the pace of digital technology utilisation (Song et al., 2021). People with greater existing socio-economic and digital privilege had a better chance of increasing their digital communication, and there was less chance of decreasing such communication. Younger people, those with higher levels of income and education, and people with more Internet skills and experience were more likely to have adopted digital communication. In turn, those without such advantages were more likely to have decreased digital communication (Nguyen et al., 2021). This conclusion was confirmed in a study by De' et al. (2020), which argued that due to the lack of resources and effective digital usage, the pandemic has created an exacerbated situation where people who are not well-connected to the Internet are excluded and suffer from other disadvantages besides. Under the conditions of the pandemic, existing socio-technical discrepancies are often magnified, and diverse forms of exclusion, marginalisation and vulnerabilities emerge (Zheng and Walsham, 2021). The pandemic has brought about a situation where those not connected to the Internet face total exclusion (De' et al., 2020).

In a study led by van Deursen (2020), several groups of people were identified as vul-

nerable, namely older people, less educated people, and people with physical health problems or low levels of literacy. Generally, people who are already relatively advantaged are more likely to use the information and communication opportunities provided by the Internet to their benefit in a health pandemic, while disadvantaged individuals are less likely to benefit; the COVID-19 crisis, therefore, serves to reinforce existing inequalities. This conclusion is also confirmed by Van Dijk (2020a), who affirms that because social inequality is increasing in many parts of the world, digital inequality will follow. The simple reason is that digital media are important tools that tend to support people in high social positions more than those in low social positions.

2. Methodology

The COVID-19 pandemic presents a research opportunity to analyse whether the more dynamic digitalisation of an economy leads to an acceleration of mitigation of digital exclusion. These specific circumstances of the COVID-19 pandemic inspire a quest for verification of the long-term exclusion of some disadvantaged social groups. Digital exclusion is perceived as a phenomenon with important consequences on the contemporary labour markets. Because of this labour market context, we rely on macro-level data covering the digital skills of the labour force and on micro-level data based on survey outcomes from the business sector. Our analysis aims to identify how digital exclusion manifests in the Slovak labour market and highlight the tendencies that the COVID-19 pandemic has accentuated.

From the macroeconomic perspective, we decided to focus on Internet non-users (those who answered "never" when asked about the frequency of their Internet use and/or a lack of access to the Internet at home) to capture the part of the population that we perceived as being most vulnerable to the digital exclusion problem. We used the autumn waves of the Standard Eurobarometer data (from 2011 to 2020), which included a question about how often the respondents use the Internet. In addition, the survey provides individual data and a variety of information about the respondents: gender, age, education, type of community (rural vs urban), and financial distress as an indicator of low income. These socio-economic characteristics were applied to identify the recent tendencies concerning the most digitally disabled population groups. The Eurobarometer data represent the population according to gender, age, and region NUTS I, and allow for international and intertemporal comparisons.

The non-use of the Internet is an extreme case of a lack of digital skills, corresponding to the "no skills" level. However, other digital skill levels are also relevant from the labour market perspective. As the next step of our analysis, we focused on the distribution of the levels of digital skills measured by the ICT Usage by Individuals and Households Survey, undertaken by the European Commission. This data source distinguishes between no digital skills, low digital skills, basic digital skills, and above. The data for the period 2016-2019 were applied to capture the main tendencies in developing the part of the population classified as having above a basic level of digital skills in Slovakia and compare them to situations in the other EU Member States.

We decided to proceed with our questionnaire survey among medium-sized and large enterprises in one EU Member State, namely Slovakia, from the microeconomic perspective. The choice of the size criterion for companies was made to increase the likelihood of achieving a representative set of answers. In addition, small companies face more barriers to the digital upskilling of their workforce. The research was carried out in the spring of 2021 on a basic set of 2944 companies. The questionnaire addressed 2326 medium-sized and 618 large companies (the entire sample of such enterprises in Slovakia, according

to the Statistical Office). This paper presents the responses of 199 companies, including 133 medium-sized and 66 large enterprises. Although the sample of 199 enterprises is not representative according to the size of the basic statistical set (at a confidence level of 95%), the data obtained provide useful information on digital skills and digital exclusion issues amid the COVID-19 pandemic. In the examined sample of 199 enterprises, the most frequently represented were in the fields of industrial production (34%), wholesale and retail trade, repair of motor vehicles and motorcycles (15%), other activities (13%), and transport and storage (7%). Thus, the structure of the examined sample largely corresponds to the structure of the basic statistical set, in which industrial enterprises comprise the largest share (38%), wholesale and retail trade, motor vehicle and motorcycle repair enterprises account for 15%, and the share of transport and storage enterprises is 8%.

3. Research results

Regarding the general outline of labour market performance, the situation deteriorated during the worldwide pandemic in 2020. In most of the EU Member States (apart from Greece, Italy, Poland, and France), the annual unemployment rate increased (Table 1). However, only a few European countries experienced an annual unemployment rate in 2020 exceeding its four-year average (2016-2019), namely Austria, Estonia, Latvia, Luxembourg, Malta, and Sweden. These results were partially achieved by important fiscal measures taken by national governments to reduce the decline in employment. In Slovakia, the aggregated data revealed a rise in the annual unemployment rate from 5.8% in 2019 to 6.7% in 2020.

Table 1. The unemployment rate in the EU

Member State	Average 2016-2019	2016	2017	2018	2019	2020
AT	5.23	6.0	5.5	4.9	4.5	5.4
BE	7.39	7.8	7.1	6.0	5.4	5.6
BG	8.93	7.6	6.2	5.2	4.2	5.1
CY	11.82	13.0	11.1	8.4	7.1	7.6
CZ	4.78	4.0	2.9	2.2	2.0	2.6
DE	4.49	4.1	3.8	3.4	3.1	3.8
DK	6.46	6.0	5.8	5.1	5.0	5.6
EE	7.43	6.8	5.8	5.4	4.4	6.8
EL	22.56	23.6	21.5	19.3	17.3	16.3
ES	20.57	19.6	17.2	15.3	14.1	15.5
FI	8.14	8.8	8.6	7.4	6.7	7.8
FR	9.66	10.1	9.4	9.0	8.4	8.0
HR	13.32	13.1	11.2	8.5	6.6	7.5
HU	7.01	5.1	4.2	3.7	3.4	4.3
IE	10.28	8.4	6.7	5.8	5.0	5.7
IT	11.04	11.7	11.2	10.6	10.0	9.2

Member State	Average 2016-2019	2016	2017	2018	2019	2020
LT	9.77	7.9	7.1	6.2	6.3	8.5
LU	5.72	6.3	5.5	5.6	5.6	6.8
LV	10.64	9.6	8.7	7.4	6.3	8.1
MT	5.09	4.7	4.0	3.7	3.6	4.3
NL	5.61	6.0	4.9	3.8	3.4	3.8
PL	7.21	6.2	4.9	3.9	3.3	3.2
PT	11.73	11.2	9.0	7.1	6.5	6.9
RO	5.96	5.9	4.9	4.2	3.9	5.0
SE	7.36	7.0	6.7	6.4	6.8	8.3
SI	7.79	8.0	6.6	5.1	4.5	5.0
SK	10.73	9.7	8.1	6.5	5.8	6.7
EU-27	**9.33**	**9.1**	**8.1**	**7.2**	**6.7**	**7.0**

Source: own elaboration based on Eurostat

The structural approach to the labour market can be presented by the analysis of the development of the unemployment rate and other labour market indicators in various social and/or age groups. For instance, the effects of the changing labour market situation on the unemployment rate of young people could also indicate the specific repercussions of the pandemic on the labour market. In our analysis, we applied the indicator of the percentage of people aged between 15 and 29 years who were neither in employment nor in education and training (NEET) in the EU, and are at risk of becoming socially excluded. The annual rate of these young people increased in 2020 in all EU countries (Table 2). In sixteen countries, the NEET rate in 2020 exceeded its four-year average (2016-2019). Thus, it seems that despite their digital potential, young people in the EU were relatively more affected by the COVID-19 pandemic than other groups of the population. In Slovakia, the NEET annual rate is among the highest in the EU, and shifted from 13.7% in 2019 to 14.4% in 2020.

Table 2. The rate of young people aged 15-29 neither in employment nor in education and training (NEET) in the EU

Member State	Average 2016-2019	2016	2017	2018	2019	2020
AT	8.88	9.0	9.3	8.8	8.6	9.9
BE	11.65	13.6	12.2	11.8	11.4	11.3
BG	19.05	22.4	18.9	18.2	16.7	18.2
CY	16.15	18.0	17.6	14.9	14.1	15.3
CZ	10.10	11.1	10.0	9.5	9.8	11.0
DE	9.30	10.0	9.6	9.0	8.6	9.6
DK	9.35	8.4	9.8	9.6	9.6	10.2
EE	11.25	13.3	10.5	11.5	9.7	11.1

Member State	Average 2016-2019	2016	2017	2018	2019	2020
EL	19.9	21.9	21.0	19.2	17.5	18.5
ES	16.18	18.1	16.4	15.3	14.9	17.3
FI	10.08	11.2	10.4	9.6	9.1	9.8
FR	13.03	13.6	13.2	12.9	12.4	13.4
HR	16.80	19.5	17.9	15.6	14.2	14.6
HU	11.20	12.0	11.2	10.6	11.0	12.32
IE	12.58	14.5	12.8	11.6	11.4	14.1
IT	23.6	24.4	24.2	23.5	22.3	23.5
LT	10.28	10.7	10.2	9.3	10.9	13.0
LU	6.85	6.8	6.6	7.5	6.5	7.7
LV	11.85	13.3	12.3	11.6	10.2	11.9
MT	8.35	9.4	8.8	7.3	7.9	9.5
NL	6.5	6.9	6.5	6.3	6.3	6.3
PL	13.53	14.8	13.7	12.9	12.7	13.8
PT	10.55	12.8	10.6	9.6	9.2	11.0
RO	22.15	24.3	22.1	21.3	20.9	20.6
SE	6.38	6.7	6.4	6.5	5.9	6.9
SI	8.05	9.3	7.9	7.5	7.5	7.9
SK	14.43	15.1	15.1	13.8	13.7	14.4
EU-27	**13.8**	**14.9**	**14.0**	**13.4**	**12.9**	**14.0**

Source: own elaboration based on Eurostat

Our survey data confirmed the relatively moderate effects of the COVID-19 pandemic on the labour market in Slovakia. 82% of enterprises stated that they were not forced to make any personnel changes, meaning they did not have to lay off or reassign anyone during the pandemic. Of the remaining 18% of enterprises, 10% had to reassign employees, 5% of companies had to lay off employees, and 3% of enterprises made redundancies and at the same time reassigned employees to other jobs. The conclusions of our research are broadly in agreement with the findings of Szeiner et al. (2021), in whose study 7% of respondents made redundancies due to the pandemic.

Although most companies did not lay off or reassign employees, the COVID-19 pandemic changed working conditions in many enterprises. Employees were motivated to use digital skills to a greater extent than before the pandemic. In response to these changes, 34% of Slovak companies in our sample confirmed via the questionnaire that they started training their employees to increase their digital skills. Most enterprises (eight) trained 10% of their employees; five companies trained 15% of their employees; in two cases, it was 50% of employees; and in two companies, they involved 100% of their employees in training.

Table 3. Internet non-users (% of the entire population aged over 15) in the EU

Member State	Average 2011-2019	2016	2017	2018	2019	2020
AT	21	18	15	17	16	10
BE	15	12	12	10	8	0
BG	37	37	29	29	26	22
CY	33	30	28	25	20	21
CZ	22	19	18	19	14	0
DE	20	20	14	15	14	8
DK	7	8	6	6	4	0
EE	20	20	19	16	16	0
EL	37	34	33	31	29	16
ES	28	26	24	23	19	17
FI	14	13	12	11	11	0
FR	19	17	17	14	13	10
HR	31	30	26	24	18	14
HU	31	28	29	25	21	20
IE	15	13	14	10	11	0
IT	26	27	22	19	20	17
LT	29	28	29	25	22	1
LU	13	11	10	9	6	0
LV	21	22	20	16	18	0
MT	28	25	22	25	21	17
NL	4	3	1	2	1	0
PL	29	28	24	25	24	16
PT	40	31	29	29	26	0
RO	42	40	42	37	30	25
SE	5	6	5	4	2	0
SI	24	21	22	22	20	0
SK	26	24	25	26	21	14
EU-27	23.64	21.89	20.26	19.04	16.70	8.44

Source: own elaboration based on Eurostat

Increased digital upskilling in 2020 was visible at the aggregate level as well. Although the EU Member States differed considerably in terms of the proportions of Internet non-users as a percentage of the population (Table 3), all countries (except for Cyprus) manifested a decline in this indicator in 2020 (Table 4), especially Portugal, Lithuania, Slovenia, Latvia, Estonia and Czechia. At the EU-27 level, the decline of 8.35 p.p. in 2020 compared to the average decline of 1.81 p.p. in 2011-2019 indicates the magnitude of the effect of the pandemic on digital upskilling. In Slovakia, the decline of the population with no digital skills by 7 p.p. in 2020 follows the tendency of the European average. However, this part of the Slovak population remains relatively high (14% of the population), exceeding the European average (8.44% of the population) in 2020.

Table 4. The decline in the proportion of Internet non-users (% of the entire population aged over 15) in the EU

Member State	Average 2011-2019	2016	2017	2018	2019	2020
AT	-2	-5	-3	2	-1	-6
BE	-2	-4	0	-2	-2	-8
BG	-3	0	-8	0	-3	-4
CY	-4	-3	-2	-3	-5	1
CZ	-2	-6	-1	1	-5	-14
DE	-2	2	-6	1	-1	-6
DK	-1	2	-2	0	-2	-4
EE	-1	-3	-1	-3	0	-16
EL	-2	-5	-1	-2	-2	-13
ES	-2	-6	-2	-1	-4	-2
FI	-1	-1	-1	-1	0	-11
FR	-2	-2	0	-3	-1	-3
HR	-3	1	-4	-2	-6	-4
HU	-3	-5	1	-4	-4	-1
IE	-2	-3	1	-4	1	-11
IT	-1	-4	-5	-3	1	-3
LT	-2	-2	1	-4	-3	-21
LU	-1	-5	-1	-1	-3	-6
LV	-1	-4	-2	-4	2	-18
MT	-2	-1	-3	3	-4	-4
NL	-1	-1	-2	1	-1	-1
PL	-2	2	-4	1	-1	-8
PT	-4	-7	-2	0	-3	-26
RO	-3	-4	2	-5	-7	-5
SE	-1	0	-1	-1	-2	-2
SI	-1	-6	1	0	-2	-20
SK	-1	-4	1	1	-5	-7
EU	-1.81	-2.74	-1.63	-1.22	-2.33	-8.35

Source: own elaboration based on Eurostat

The process of upskilling the labour force had been evident even before 2020 at the EU level, reflecting the rise of individuals with above a basic level of digital skills (Table 5). The highest proportion of the most skilled population groups could be found in Finland, the Netherlands, Denmark, and Sweden, according to available data from 2019. In Slovakia, the most skilled labour force represented 27.01% of the population, which was below the European average (33.31%) in 2019, and the gap seemed to increase in 2019.

Table 5. Individuals with above a basic level of digital skills (% of the population aged 16-74) in the EU Member States

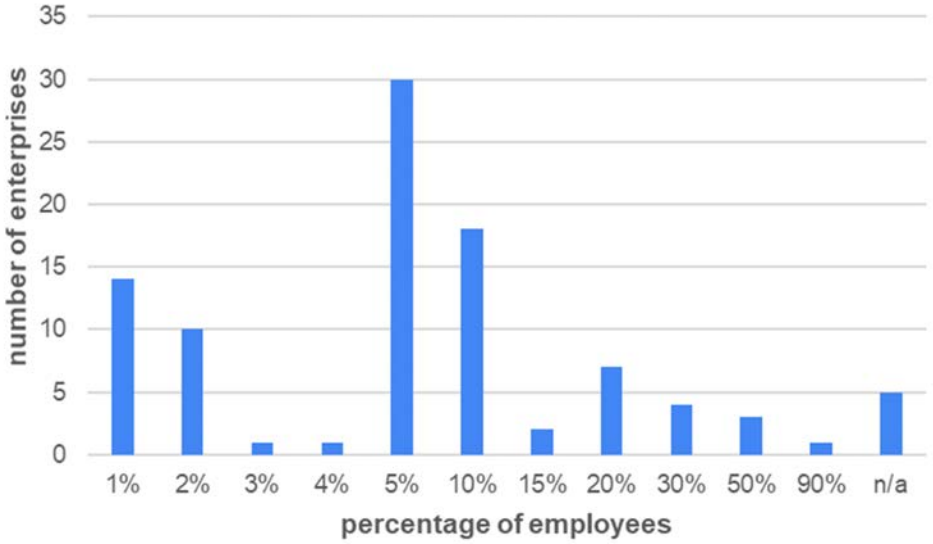
Member State	Increase 2015-2019	2015	2016	2017	2018	2019
AT	6.44	32.79	34.59	36.22	36.22	39.23
BE	3.05	31.13	31.53	30.99	30.99	34.18
BG	-1.46	12.75	10.07	11.05	11.05	11.29
CY	9.88	15.36	20.44	18.71	18.71	25.23
CZ	2.87	22.93	20.42	24.06	24.06	25.79
DE	3.55	35.30	33.48	36.71	36.71	38.84
DK	0.07	48.46	52.98	47.22	47.22	48.53
EE	-0.41	37.44	34.74	34.84	34.84	37.03
EL	7.22	16.11	19.36	21.66	21.66	23.32
FI	9.13	40.94	43.74	45.23	45.23	50.07
FR	4.07	26.85	27.57	29.24	29.24	30.92
HU	2.94	22.42	23.82	25.75	25.75	25.36
IE	9.13	25.01	24.80	27.74	27.74	34.14
IT	2.70	19.32	19.47	n.a.	n.a.	22.02
LT	2.01	30.29	29.15	31.94	31.94	32.30
LU	-	55.89	54.15	55.25	n.a.	n.c.
LV	-1.09	25.54	26.63	26.80	26.80	24.45
MT	3.71	34.54	31.95	38.70	38.70	38.25
NL	7.04	42.52	44.87	47.85	47.85	49.56
PL	6.23	15.07	19.40	21.13	21.13	21.29
PT	4.22	27.88	28.34	30.75	30.75	32.10
RO	1.36	8.97	8.59	10.15	10.15	10.33
SE	10.80	35.24	38.80	46.38	46.38	46.04
SI	5.45	25.62	27.78	29.69	29.69	31.07
SK	0.99	26.07	29.12	33.07	33.07	27.07
EU	5.08	28.23	29.30	31.19	31.19	33.31

Source: own elaboration based on Eurostat

One of the most important skills related to the outbreak of the COVID-19 pandemic became the ability to adapt to new requirements, mainly the need to work remotely. For this reason, in our research, we investigated the extent to which companies and their employees had difficulty meeting new, increased digital skills requirements. As an indicator, we chose the percentage of company employees (managerial estimate) who could not adapt to the increased demands for digital skills during the crisis. The results of the survey are shown in Figure 1. In more than half of the enterprises (52%), the employees

did not have a problem adapting to the new digital skills requirements brought about by the pandemic. In 96 enterprises, however, they experienced difficulties accommodating the changing conditions; 30 enterprises answered in the questionnaire survey that 5% of their employees had a problem adapting to the new requirements for digital skills. These enterprises were mainly in the fields of industrial production (10) and transport and storage (five), with medium to large enterprises being represented in a ratio of 2 to 1. The second-largest group of 18 enterprises estimated that 10% of their employees had a problem adapting to new digital skills requirements during the COVID-19 pandemic. In one enterprise, this problem occurred for up to 90% of employees – a large enterprise which, according to the Slovak Nomenclature of Economic Activities, belonged to the classification of wholesale and retail trade, repair of motor vehicles, and motorcycles.

Figure 1. Percentage of employees who were not able to adapt to the increased demands for digital skills during the COVID-19 pandemic



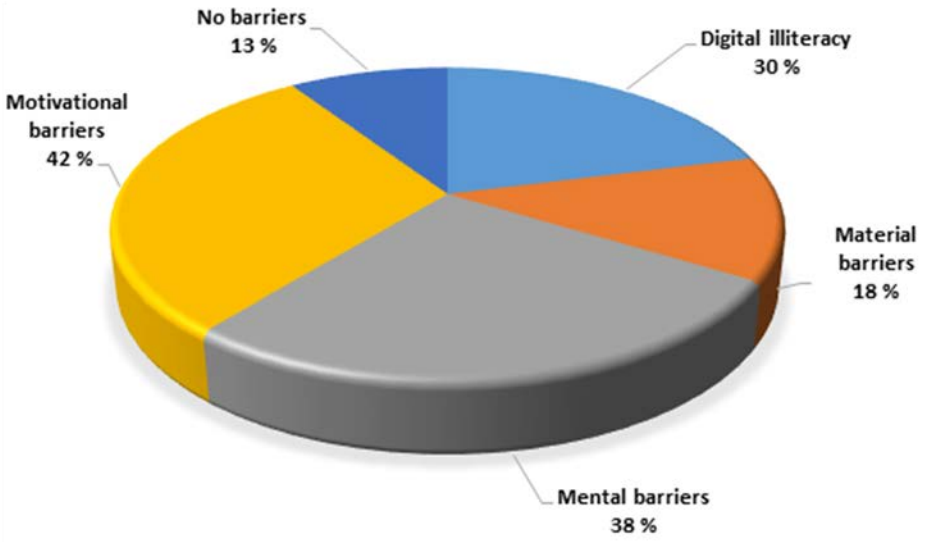
Source: own elaboration

Due to the growing need to work from home and the increased demands on digital skills, during the period of the COVID-19 pandemic companies became more aware of the issues that prevented enterprises from using and improving their employees' digital skills. The authors dealing with this topic have identified several barriers faced by enterprises. We have divided these barriers into four groups: digital illiteracy, motivational barriers, mental barriers, and material barriers (Figure 2). Regarding the term "digital illiteracy" in the professional literature, we found it challenging to find a plausible definition. Rather, we were able to find a definition of the term "digital literacy". According to Buckingham (2015), digital literacy means minimal skills that allow people to work with software tools. It is therefore a basic ability that is required to undertake specific operations. Using the given definition of digital literacy, by digital illiteracy, we mean a lack of basic digital knowledge and experience or a reluctance to acquire a PC and overcome this illiteracy. We do not see digital illiteracy as a barrier to the future development of

digital skills, but as a barrier to their current use. Almost immediately following the outbreak of the COVID-19 pandemic, enterprises were obliged to utilise the digital skills of their employees. We wondered to what extent the digital illiteracy of their employees prevented them from doing so. Mental barriers are linked to a lack of awareness of today's need to master a certain level of digital skills. Motivational barriers lie in the absence of, or in weak, motivation to develop digital skills. According to De Haan (2004), these barriers overlap to some extent as mental barriers are understood as so-called mental accessibility, which means the willingness of people to adopt new technology; material barriers, however, are related to the objective situation in which a person finds themself in terms of material security, e.g. low income or living in poverty, which leaves them unable to own a computer or connect to the Internet.

Most enterprises perceive motivational (42%) and mental (38%) barriers as a problem, while 18% of enterprises mention a combination of both obstacles. On the one hand, it is satisfying that material barriers to improving digital skills do not play a significant role (18% of companies cited material reasons as an obstacle); on the other hand, there is a relatively high percentage of those who see a problem in their employees' mental attitudes to digital skills.

Figure 2. Barriers faced by enterprises in the field of digital skills



Source: own elaboration

At the macroeconomic level, a crucial aspect of digital exclusion is linked to identifying digitally vulnerable population groups. Eurobarometer data from 2019 (Eurobarometer 92.3) and 2020 (Eurobarometer 94.3) allowed us to depict the different factors playing a role in the probability of being an Internet non-user for all EU Member States. Using these variables, we ran a logit regression to indicate the extent to which the individual risk factors contributed to digital exclusion and whether the effect was mitigated after the outburst of the pandemic. We regressed a dummy variable indicating Internet non-users on independent variables indicating female gender, low education, living in a rural area, age above 55, financial distress, and additionally a dummy variable indi-

cating that the observation is from the year 2020 (the description of variables, descriptive statistics, and correlation matrix is available in the Appendix). The categorical variable 'country' was added to depict differences among individual EU countries. This allows us to indicate a country-specific probability of being an Internet non-user. We hypothesised that, due to increased pressure on using digital technology in the year 2020, the observations from this year would show a lower probability of being an Internet non-user.

Table 6 presents the results as the average marginal effects of the estimated coefficients from logit regressions. All the determinants – female gender, low education, living in a rural area, age above 55, financial distress, and a dummy variable indicating that the observation is from 2020 – were statistically significant. However, it must be said that the high significance of all the factors is predominantly the result of the high number of observations. As to the economic significance, a 0.7% increase in the probability of being an Internet non-user as a female could be considered negligible. By contrast, being over 55 years of age and having a low level of education represent persistent factors in digital exclusion. The results confirm that the year 2020 represents a factor which decreases the probability of being an Internet non-user by 8% on average. The analysis showed differences among the countries in all social groups. Coming from the Nordic (Sweden, Denmark, Finland) and Benelux countries significantly decreases the probability of digital exclusion. On the other hand, the inhabitants of certain post-communist countries (Romania, Bulgaria, Poland, Slovakia, Hungary) and Cyprus have a 10% higher probability of being an Internet non-user than the average European.

Table 6. Factors of the probability of being an Internet non-user in the EU Member States

	Average marginal effects	Standard error	95% confidence interval	
Female	.0078183***	.0024088	.0030971	.0125396
Low Education	.1704444***	.0041449	.1623206	.1785683
Rural Area	.0316996***	.0026505	.0265048	.0368944
Age 55 and over	.2254336***	.0028019	.219942	.2309253
Financial Distress	.0485407***	.0047936	.0391454	.057936
The year 2020	-.0831766***	.0024427	-.0879642	-.0783889
Country				
AT	-.012546	.0087612	-.0297175	.0046256
BE	-.072632***	.0077801	-.0878807	-.0573832
BG	.1279149***	.0098667	.1085766	.1472533
CY	.1136289***	.012262	.0895958	.1376621
CZ	-.0273832**	.0094387	-.0458828	-.0088836
DE	-.0179349*	.0075171	-.0326682	-.0032015
DK	-.0724989***	.0081512	-.088475	-.0565228
EE	-.0051918	.0086853	-.0222147	.011831

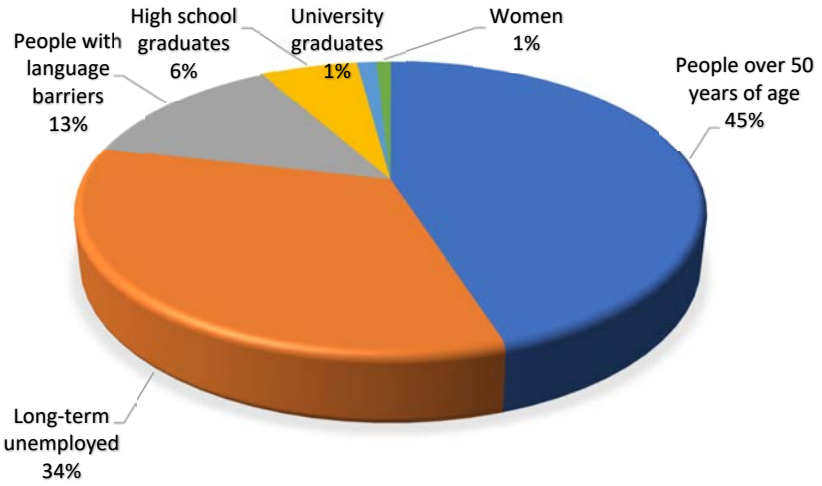
	Average marginal effects	Standard error	95% confidence interval	
EL	.0590163***	.0097817	.0398444	.0781882
ES	.0097412	.0084537	-.0068278	.0263101
FI	-.0490947***	.0079354	-.0646478	-.0335415
HR	.0341245***	.0099207	.0146802	.0535688
HU	.1011402***	.0096014	.0823218	.1199585
IE	-.0567604***	.0080075	-.0724548	-.0410661
IT	.033129***	.0089469	.0155933	.0506647
LT	.0229338**	.008887	.0055155	.040352
LU	-.0756853***	.0093869	-.0940833	-.0572874
LV	.0075899	.008857	-.0097695	.0249492
MT	.0149529	.0100162	-.0046784	.0345842
NL	-.1224643***	.0063801	-.1349691	-.1099595
PL	.1246704***	.0098947	.1052771	.1440637
PT	-.020978*	.0085451	-.0377261	-.0042298
RO	.1475986***	.0103798	.1272546	.1679427
SE	-.1027559***	.0071647	-.1167985	-.0887133
SI	-.0138223	.0086365	-.0307497	.003105
SK	.1103765***	.0096335	.0914952	.1292577
LR chi-square	16253.79			
Log-likelihood	-13358.722			
Observations	53 516			

legend: * p<0.05; ** p<0.01; *** p<0.001

Source: own elaboration based on Eurostat.

The goal of one question in our micro-level survey was to ascertain which characteristics are typical for labour market participants who have unsatisfactory digital skills. In the survey, we defined six characteristics: age over 50, secondary education, higher education, language barriers typical of minorities (foreigners, national minorities), long-term unemployment (longer than one year), and gender distribution (Figure 3).

Figure 3. Enterprise perceptions of groups possessing lower digital skills



Source: own elaboration

Our survey confirmed the findings of other scholars (Ertl et al., 2020; Hargittai et al., 2002), where the largest number of companies identified age as one of the decisive factors in the insufficient level of digital skills. As many as 150 of 199 companies reported that people over the age of 50 are among the most disadvantaged jobseekers in terms of digital skills. As a study by Kolářová et al. (2017) shows, the overall situation of people aged over 50 in the labour market is generally unfavourable. At the beginning of the development of ICT, gender differences were perceived as an important factor determining job seekers' level of digital skills; however, gender no longer plays such a role, which was confirmed by our study. Only ten companies reported gender as a characteristic related to the level of digital skills, with women being mentioned in seven cases and men in three cases.

More than half of the enterprises (56%) consider long-term unemployment a problem determining unsatisfactory digital skills. Among the demographic with insufficient digital skills were high school graduates (as mentioned by 44 enterprises); 20 enterprises noted the presence of university graduates. In this context, it is of interest that the most recent information and communication technology skills test in Slovakia (European Commission, 2020) showed that although 59% of adults have basic digital skills, there are shortcomings among young people, especially in terms of office software such as working with text or spreadsheet editors.

Discussion and Conclusions

The advent of COVID-19 has changed the labour market situation, especially the situation associated with enterprises and working conditions. According to our survey, 34% of Slovak companies in our sample confirmed that they have started to train their employees to improve their digital skills. Our findings are in line with those of Gigauri (2020), who undertook a similar study on the HRM response to the COVID-19 pandemic in Georgia, finding that human resources managers have generally adopted a strategy to help employees increase their home office skills, made flexible working hours more frequent and adopted less stringent performance management policies. Higher management has encouraged human resources managers to take measures that will contribute to employees' physical and

emotional well-being. These results emulate the conclusions of Przytuła et al. (2020), who claim that the post-pandemic reality will require new competencies of both managers and employees, and re-skilling and re-training are the most common approaches.

Internet non-users can be perceived as the most visible part of the digitally excluded labour force. According to our findings, the proportion of Internet non-users in the Slovak and European population declined considerably during the pandemic. Amankwah-Amoah et al. (2021) offer a possible explanation, claiming that COVID-19 has evolved to be a kind of "catalyst" for the adoption and increasing use of digitalisation in work organisations and the office.

Despite identifying positive tendencies concerning the digitally excluded labour force in general, a negative aspect of labour market evolution could also be identified. An increase in the unemployment rate was observed in Slovakia and other EU Member States with the advent of the COVID-19 pandemic. This may be partly explained by Schmidpeter and Winter-Ebmer (2021), according to whose findings unemployed workers who have the skills to adapt to new situations face better labour market outcomes with higher wages and job stability. Those workers who cannot cope with technological change suffer prolonged unemployment and end up with fewer employment options. However, the sudden emergence of the COVID-19 pandemic has negatively affected the rate of young people's NEET. Since people aged 15-29 are generally considered a digitally privileged part of the population, our observations confirm that possessing a certain level of digital skills is a necessary but not sufficient condition of labour market access in case of a sudden supply shock.

From a certain point of view, our results are in contrast to Beaunoyer et al. (2020), according to whose study digital inequalities already existed, albeit the COVID-19 crisis exacerbated them dramatically. Additionally, Van Dijk (2020b) stated that the current COVID-19 pandemic reinforces digital inequality. Both views were expressed in 2020, i.e. at the beginning of the pandemic, while our survey research was conducted in 2021. This time lag and the associated experience level with the pandemic may also explain the different results.

Another negative tendency in the Slovak labour market could be identified when focusing on the different levels of digital skills of the population in more detail. For example, the proportion of the most-skilled individuals (the section of the population with above a basic level of digital competence) in Slovakia decreased by 6% between 2018 and 2019, while it mostly increased in other European countries in the same period. According to Eurostat data, the decrease occurred in every age category measured by the methodology. Although our research cannot determine the cause of this decline, we consider this figure to be an interesting change outside the general trend.

Our findings agree with Bach et al. (2013) that policymakers must design digital inclusion initiatives that ultimately lead to diversity in media ownership, expand digital literacy, and teach participants to create meaningful content. Priority needs to be placed on policies to ensure that older individuals (Adamczyk and Betlej, 2021), individuals with low education levels, and low-income individuals are not left behind by digital transformation.

Our analysis aimed to identify how digital exclusion manifests in the Slovak labour market and highlight the tendencies that the COVID-19 pandemic has accentuated. We attempted to contribute to the discussion of whether the more dynamic digitalisation of the economy that occurred in 2020 (Dvořák et al., 2020) could accelerate the mitigation of digital exclusion, reducing the long-term exclusion of some disadvantaged social groups. Our results concerning the mitigation of the general problem of digital exclusion during

the pandemic in Slovakia and the other EU Member States are rather promising. The proportion of Internet non-users in the population declined considerably. However, we identified a possibility of persistence for the digitally disadvantaged groups of the population among those who are at least 55 years old, those with a low education level, and people in financial distress. All these factors increase the probability of being an Internet non-user to a greater extent in Slovakia than in the EU on average.

Our results underline the fact that companies could help their employees develop their digital skills and resilience. Initiatives at the company level could be an efficient supplement to the initiatives of policymakers. We assume that the situation caused by the COVID-19 pandemic increased demands on work requiring digital skills; initiatives borne from these new circumstances could help negate the most extreme cases of digital exclusion (the level of no digital skills whatsoever), but they could also enhance the other levels of digital skills. The concrete actions of companies could be in the form of companies' proactive responses to new challenges (Patey et al., 2022) and become a part of employees' well-being activities – the rapid provision of technology and equipment and virtual networks for workers to share experiences and offer support.

At the same time, it can be expected that the post-COVID new reality will not only lead to an awareness of the need to increase digital skills, but will also increase the motivation of employees to learn and develop their knowledge in the field of digital technologies. Digital illiteracy can be associated with reluctance or weak motivation to acquire at least elementary digital skills. Our survey results show that this situation is not just a consequence of poverty, low income, or the inability to obtain a computer for financial reasons. A relatively high percentage of managers see a problem in their employees' motivation and mental attitudes to the achievement of digital skills.

The problem of persistent inequality and social exclusion demands a deeper understanding of the intersection between technology and inequality and, correspondingly, a more aggressive and nuanced plan to address this problem. Bach et al. (2013) argue for a Digital Human Capital framework, a concept which is intended to build on and extend the call for additional technology access and basic training programmes, considering the complex nature of social exclusion in the information age. Future research should focus on applying this broader concept in the context of the Slovak labour market.

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Appendices

Appendix 1. Definition of variables

Variable	Code	Definition	Measurement method
Female	1 0	Female Male	Information provided by the respondent
Low education	1 0	Person who completed his/her education at the age of 16 or under Person who completed his/her education aged over 16	Computed from the variable "Age of leaving full-time education"
Rural area	1 0	Person living in a rural area or village Person living either in a small or medium-sized town or in a large town	Self-defined by the respondent. The variable is not based on measurable characteristics of the dwelling but on the subjective evaluation of the respondent
Aged 55 and over	1 0	Person 55 years old or more Person younger than 55	Computed from the variable Age
Financial Distress	1 0	Person who declared difficulties with paying bills last year for the majority of the time Person who declared difficulties with paying bills last year either from time to time or almost never/never	Information provided by the respondent, based on the subjective evaluation of the respondent

Appendix 2. Descriptive statistics

	Internet users (%)	Internet non-users (%)	Total
Female	50.00	59.66	51.66
Low Education	15.22	55.42	22.11
Rural Area	28.72	38.91	30.47
Aged 55 and over	29.04	88.12	39.16
Financial Distress	7.12	11.11	7.80

Appendix 3. Matrix of correlations (p-values shown in the brackets)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) no_use	1.000						
(2) woman	0.031	1.000					
	(0.158)						
(3) low_edu	0.272	0.046	1.000				
	(0.000)	(0.034)					
(4) rural	0.077	-0.022	0.108	1.000			
	(0.000)	(0.300)	(0.000)				
(5) old	0.477	0.028	0.130	0.044	1.000		
	(0.000)	(0.194)	(0.000)	(0.042)			
(6) fin_problems	0.034	0.013	0.147	0.007	-0.026	1.000	
	(0.118)	(0.544)	(0.000)	(0.737)	(0.231)		
(7) _2020	-0.158	0.017	-0.058	-0.055	-0.077	0.028	1.000
	(0.000)	(0.439)	(0.007)	(0.011)	(0.000)	(0.201)	