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PROTECTION OF EMPLOYEES' WORKING CONDITIONS IN RELATION TO THE INTRODUCTION OF TECHNOLOGICAL CHANGES IN JOBS

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Introduction

This study addresses the issue of the digital transformation of the labour market, i.e. the issue of how the labour market will be affected by the introduction of digital technologies of all kinds. This phenomenon is not new, it can be observed with a bit of abstraction in the form of the introduction of technologies since the Industrial Revolution in the 19th century. It gained the attention of sociology and economics theorists especially in the 1970s, when it was no longer about machines in the form of weaving machines or steam propulsion, but about genuine digitalization in the form of the first commercial computers. Their use most likely saved numerous groups of the then graduates from the threat of unemployment or at least the need to take a job for which they are overqualified.

So why discuss the digitalization of the labour market today? Because this phenomenon has accelerated significantly in recent years and it affects more and more parts of the labour market in the form of the so-called technological turn. While usually only programmers and operators worked with computers and managers consumed only the printed results of computer work and regular workers probably never used it in the 1970s, the situation is completely different today. Even manual occupations must be prepared to use digital devices and industrial computers for their work. The least qualified jobs are probably long ago replaced by machines or moved to a country with a cheaper workforce and looser legislative conditions. However, the development of collaborative robots controlled by artificial intelligence threatens jobs that could be described as semi-skilled to skilled. Artificial intelligence transforms and largely takes over jobs even in previously safe groups of office employees and people who perform creative work.

Technological development is gaining unimaginable momentum and it is more than certain that any study trying to predict what the labour market will look like in a year or two will be invalid in six months and ridiculous rather than useful in two years. Therefore, we decided to take a slightly different approach. We describe the digitalization of the labour market in the broadest possible context of technological change as such. We thus try to describe in this study not only the impact of digitalization, but also the impact of robotics, the development of computer technology and the Internet and the unstoppable advent of artificial intelligence. We describe all this in a broader economic and historical context, but we also do not avoid specific case micro-studies dealing with selected occupation groups. In a limited space, we try to combine the results of our own research with descriptive analyses of sample surveys, estimates of consulting companies and major economic media, as well as our own interpretation of the above sources. We suggest recommendations in relevant places on how the impact of various phenomena could be mitigated or even reversed, with regard to employees and the preservation of their jobs.

It is a big question what the labour market will look like after the introduction of all robotic, digital and artificial intelligence innovations or whether we will be able to talk about the labour market as such. Various estimates indicate that about 40 to 60% of today's employees will lose their jobs in a relatively short period of five to ten years at most.

This phenomenon occurred several times in the history of mankind. For the first time during the Industrial Revolution, when factories of all kinds were created. For the second time in the post-war period, when there was massive mechanization in agriculture. For the third time in the 1970s, when the use of machines developed and part of the labour market was moved to

developing countries. This change was relatively slow in all cases and employees were able to adapt to it, although it always included a number of social and economic shocks. However, the current digital revolution is happening too quickly and too across the labour market. There are thus concerns that new jobs will not be created at all or not quickly enough or they will also be taken over by machines, digital services or artificial intelligence immediately after their creation.

The need to work is deeply rooted in Western society. People find work rewarding, it allows them to gain at least part of their identity ('I am a warehouse worker in screw production', 'I work as an economist' is one of the first sentences by which we introduce ourselves to others) and, last but not least, financial security. Sociological research often shows that the willingness of society to contribute economically to people who do not work is significantly lower than in the case of, for example, pensioners, sick people or mothers on parental leave.

Doseděl (2021) shows three possible scenarios for the development of the labour market if it will not be able to quickly adapt to the ongoing technological turn. One option is a transformation of social values in such a way that it will be normal for a part of society not to work. Their economic needs will be addressed by some form of unconditional basic income which we make money for by taxing robotic labour, for example. The second option is to create artificial jobs that justify obtaining economic income through work that is not socially necessary (a reference to Charles IV and his Hunger Wall is completely appropriate). In this respect, the state has great opportunities, for example, to increase the number of employees in the state administration if it is able – e.g. by the aforementioned taxation of robotic labour – to secure funds for their employment. The third option is that we will just play at employees. Instead of going to work in the morning, each of us enters a kind of virtual reality where we pretend to work, for which we will receive a financial reward. If this option seems unrealistic to you, take a look at the rankings of the most popular computer games. Today's children are no longer playing heroes, but farmers managing their own farms, waiting staff in cafes or truck drivers going across Europe.

Structure of the study

We divide the entire study as follows. The first chapter presents the broader context of the macroeconomic development of the Czech Republic. First, we follow the development of GDP in the sectoral breakdown (Section 1.1), then we move to the relationship between gross domestic product and other macroeconomic aggregates, especially gross national income (Section 1.2) and we end the chapter with a look at regional GDP indicators (Section 1.3). We pay special attention to the impact of foreign direct investment affecting both some sectoral indicators (we will show this on the example of data broken down by institutional subsectors of the non-financial enterprises sector) and the amount of primary income with non-residents.

The second chapter is devoted to an overview of the historical development of implementing technologies, from the iconic weaving machine and steam propulsion, which jointly started the (first) Industrial Revolution, to the currently ongoing development of artificial intelligence. Particular emphasis is placed on the working conditions of employees, especially the growing proportion of people with a non-standard concept of employment, whether it is flexible (precarious) employment, false self-employment or platform employment (increasingly common in the digital age). We believe that trade unions should pay close attention in the

near future in particular to addressing these ‘non-standard’ employees and trying to collectively protect their employment rights.
The third chapter directly follows in this problem and asks the general question who a member of trade unions is today, whom they actually represent in their work. Based on a sample survey by the International Social Survey Programme for the Czech Republic, it first describes the socio-demographic determinants of trade union membership. Then, using binary logistic regression, it shows the net impact of individual characteristics of respondents and gives trade unions clear instructions on what type of people they actually speak for at the moment and what type of people they should focus on in their acquisition efforts if they want to expand their reach even further.

The fourth chapter shows the readiness of individual groups of the Czech population for the upcoming digitalization. Based on the analysis of the sample survey on the use of information and communication technologies in households and among individuals, we show which socio-demographic or employee groups regularly use the Internet and its selected services. We conclude that young educated workers in white collar occupations are best equipped with digital skills, while older and less educated workers in manual occupations are at the greatest risk of not being able to adapt to the digital age.

When preparing the fifth chapter, we considered the forecasts of selected consulting companies and prestigious foreign economic media, which have recently published various rankings of occupations most affected by the ongoing digital revolution. Based on the research of these sources, we prepared several case studies in which we first described the expected impact of the introduction of technologies on a specific occupation group and then, based on the analysis of the Labour Force Survey for the Czech Republic, showed how this occupation is represented on the Czech labour market and which groups of people perform it. Trade unions thus have the opportunity, in conjunction with information from other chapters, to focus their attention on these vulnerable groups.

The sixth chapter shows clearly selected problems that the Czech labour market faces in connection with the current deployment of technologies, digital services and artificial intelligence. In this case, we also indicate what countermeasures can be used for each problem to mitigate or eliminate its effects.

The final chapter clearly summarizes the most important findings of the previous chapters and puts the activities recommended to trade unions into this context.

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1. Macroeconomic framework

This chapter presents the development of gross domestic product since 1995 in various breakdowns, taking into account the importance of individual sectors, the impact of foreign investment and development in individual regions of the Czech Republic. Please note that all data used in this subchapter are data from the second half of June 2023. The Czech Statistical Office will publish updated estimates of annual national accounts, which are the result of a regular annual revision of national accounts, on 30 June 2023, i.e. only after the date of submission of this study. The data in this study may therefore differ from the CZSO data published on 30 June 2023.

1.1 Gross domestic product by sector

Let's start with the development of GDP in five-year intervals from 1995 to 2020 and further in 2021 and 2022 broken down by sector.

Table 1 Development of gross value added in sectors of the national economy 1995-2022, constant prices 2015

In millions of CZK								
NACE	1995	2000	2005	2010	2015	2020	2021	2022
TOTAL	2 557 418	2 767 186	3 354 863	3 829 223	4 165 174	4 532 168	4 687 227	4 801 533
A Agriculture, forestry and fishing	101 306	99 243	121 516	92 416	102 277	125 324	106 682	104 083
B Mining and quarrying	75 245	51 066	44 811	38 403	37 558	22 411	21 521	22 326
C Manufacturing	389 873	514 850	694 838	943 516	1 106 468	1 188 354	1 247 023	1 282 745
D Electricity, gas, steam and air conditioning supply	182 338	170 994	203 074	188 074	140 043	122 757	126 183	118 752
E Water supply; sewerage, waste management and remediation activities	57 493	57 736	59 615	53 957	42 872	44 426	41 736	38 441
F Construction	292 789	185 759	224 682	244 215	235 596	202 886	197 395	200 995
G Wholesale and retail trade; repair of motor vehicles and motorcycles	136 438	194 152	302 017	357 784	457 816	506 987	524 612	512 667
H Transportation and storage	246 365	266 704	286 418	267 923	237 863	260 303	296 591	327 516
I Accommodation and food service activities	150 627	129 578	104 433	85 580	78 089	45 931	45 158	55 173
J Information and communication	72 821	98 031	138 696	176 759	216 062	320 100	338 254	355 094
K Financial and insurance activities	76 202	116 076	99 508	154 472	177 664	241 157	255 098	258 971
L Real estate activities	236 910	260 698	287 939	314 306	356 041	370 895	355 808	365 800
M Professional, scientific and technical activities	148 880	134 246	176 864	178 873	213 109	251 433	282 619	293 279
N Administrative and support service activities	57 884	47 920	57 075	64 881	75 073	74 952	80 887	83 520
O Public administration and defence; compulsory social security	225 805	225 588	239 138	259 425	245 433	260 959	263 555	262 650
P Education	156 446	151 248	162 195	164 035	174 498	192 847	196 260	201 041
Q Human health and social work activities	215 098	171 681	183 520	184 088	179 356	205 340	217 478	221 307
R Arts, entertainment and recreation	46 950	37 573	37 641	34 171	41 707	52 871	58 640	68 713
S Other service activities	74 254	56 110	44 412	48 270	44 185	38 702	38 682	40 097
T Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	654	1 073	1 818	2 818	3 464	4 180	4 884	4 659

Source: CZSO Database of Annual National Accounts, Table M000104c; data as of 22 June 2023.

Let's look at the development of gross value added in individual years compared to 1995 using basic indices (1995=100); see Table 1.2.

Table 1.2 Development of gross value added in sectors of the national economy 1995-2022, constant prices 2015, 1995=100

NACE	1995	2000	2005	2010	2015	2020	2021	2022
TOTAL	100,0	108,2	131,4	150,0	163,3	177,6	183,7	188,1
A Agriculture, forestry and fishing	100,0	98,1	120,1	91,3	101,0	123,9	105,4	102,9
B Mining and quarrying	100,0	67,8	59,5	50,9	49,8	29,8	28,6	29,6
C Manufacturing	100,0	132,1	178,2	241,9	283,8	305,0	320,0	329,3
D Electricity, gas, steam and air conditioning supply	100,0	93,7	111,2	103,1	76,6	67,1	69,0	64,9
E Water supply; sewerage, waste management and remediation activities	100,0	100,4	103,6	93,8	74,5	77,2	72,5	66,8
F Construction	100,0	63,5	76,8	83,5	80,7	69,5	67,7	68,9
G Wholesale and retail trade; repair of motor vehicles and motorcycles	100,0	142,4	221,5	262,0	335,8	371,7	384,7	375,8
H Transportation and storage	100,0	108,1	116,2	108,5	96,4	105,4	120,1	132,6
I Accommodation and food service activities	100,0	86,0	69,3	56,8	51,8	30,5	30,0	36,6
J Information and communication	100,0	134,7	190,6	242,7	296,7	439,6	464,7	487,9
K Financial and insurance activities	100,0	152,3	130,5	202,4	232,8	316,0	334,3	339,3
L Real estate activities	100,0	110,1	121,5	132,7	150,1	156,4	150,0	154,2
M Professional, scientific and technical activities	100,0	90,1	118,7	120,0	143,1	168,8	189,7	196,9
N Administrative and support service activities	100,0	82,8	98,6	112,2	129,9	129,6	139,9	144,5
O Public administration and defence; compulsory social security	100,0	99,9	105,9	115,0	108,7	115,6	116,8	116,4
P Education	100,0	96,7	103,6	104,9	111,6	123,3	125,5	128,5
Q Human health and social work activities	100,0	79,9	85,4	85,6	83,5	95,7	101,3	103,1
R Arts, entertainment and recreation	100,0	80,0	80,1	72,6	88,7	112,4	124,6	146,1
S Other service activities	100,0	75,6	59,8	65,1	59,6	52,2	52,2	54,1
T Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	100,0	164,0	277,9	430,6	529,1	638,6	746,6	712,2

Source: Own calculation (concatenation of indices) based on the CZSO data (Database of National Accounts, Table M000104d); data as of 22 June 2023.

At first glance, we can see completely different developments in individual sectors. Total gross value added approximately doubled between 1995 and 2022 at constant prices (more precisely, it was 88.1% higher in 2022 than in 1995). Value added increased significantly in the information and communication sector (by 387%, i.e. almost five times), in the trade sector (+275%), in financial and insurance activities (+239%) and finally in manufacturing (+229%). On the other hand, real added value decreased in the sectors of mining and quarrying (by 70%), accommodation and food service activities (by two thirds), construction and in energy and water supply sectors (both by a third).

This also leads to a change in the sectoral gross value added, expressed in current prices and recorded in Table 1.3.

The share of agriculture, forestry and fishing fell by about half in 2022 compared to 1995 and the share of the mining and quarrying sector also fell significantly. Development in the manufacturing sector is remarkable: while development between 2005 and 2010 witnessed the transition from an industrial economy to a service economy, the trend reversed again between 2010 and 2015. The share of the manufacturing sector has been slightly decreasing again since 2015, partly due to problems during the COVID-19 pandemic. The share of the information and communication sector is gradually growing, which is important due to the high share of added value in production, to which we will return. Similarly, the share of the real estate sector and partly also the professional, scientific and technical activities sector is constantly growing. The share of education is growing slightly.

Table 1.3 Sectoral structure of gross value added 1995-2022, current prices

NACE	1995	2000	2005	2010	2015	2020	2021	2022
TOTAL	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00
A Agriculture, forestry and fishing	4,44	3,57	2,53	1,70	2,46	2,15	2,03	2,33
B Mining and quarrying	2,23	1,32	1,24	1,25	0,90	0,51	0,49	0,61
C Manufacturing	23,73	25,66	25,01	23,16	26,56	23,46	23,20	23,36
D Electricity, gas, steam and air conditioning supply	4,39	2,66	3,15	4,03	3,36	3,11	2,85	2,97
E Water supply; sewerage, waste management and remediation activities	0,94	0,96	1,10	1,16	1,03	0,99	1,17	1,14
F Construction	7,66	6,16	6,67	7,05	5,66	5,65	5,59	5,75
G Wholesale and retail trade; repair of motor vehicles and motorcycles	10,52	11,77	11,22	10,54	10,99	10,88	10,93	10,31
H Transportation and storage	6,86	7,28	6,83	6,11	5,71	5,37	5,71	5,84
I Accommodation and food service activities	3,37	3,22	2,57	2,10	1,87	1,26	1,26	1,73
J Information and communication	3,04	4,30	4,83	5,13	5,19	6,88	6,92	6,85
K Financial and insurance activities	3,39	3,15	3,13	4,63	4,27	4,11	4,10	3,87
L Real estate activities	5,81	7,87	8,06	9,14	8,55	9,72	9,28	9,64
M Professional, scientific and technical activities	4,64	4,26	4,87	4,84	5,12	5,29	5,59	5,56
N Administrative and support service activities	2,00	1,69	1,80	1,96	1,80	1,80	1,87	1,85
O Public administration and defence; compulsory social security	6,71	6,48	6,75	6,55	5,89	6,27	6,03	5,75
P Education	4,08	3,73	4,11	4,20	4,19	5,10	5,17	5,04
Q Human health and social work activities	3,63	3,43	3,81	4,13	4,31	5,47	5,82	5,30
R Arts, entertainment and recreation	0,98	1,13	1,14	1,04	1,00	0,92	0,94	1,07
S Other service activities	1,56	1,33	1,12	1,20	1,06	0,95	0,94	0,94
T Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0,02	0,04	0,05	0,07	0,08	0,10	0,11	0,10

Source: Own calculation based on CZSO data (Database of National Accounts, Table M000104a; data as of 22 June 2023.

In addition to the sectoral breakdown, we can also see how individual sectors contributed to the gross value added. We divide the results into three tables, 1.4 to 1.6. Data in this case are

available only until 2020; it is possible that the CZSO will release data for 2021 when publishing the semi-definitive report of national accounts for 2021, expected on 30 June 2023.

In the public sector, the CZSO includes institutional units classified in the (sub)sectors: S.11001, S.121, S.12201, S.12301, S.12401, S.12501, S.12601, S.12701, 12801, S.12901 and S.13.

The national private sector includes institutional units included in the following (sub)sectors: S.11002, S.12202, S.12302, S.12402, S.12502, S.12602, S.12702, S.12802, S.12902, S.14 and S.15.

The 'foreign-controlled' sector includes institutional units classified in the (sub)sectors: S.11003, S.12203, S.12303, S.12403, S.12503, S.12603, S.12703, S.12803 and S.12903.

The addition up to 100% consists of net taxes on products.

The share of added value created in the public sector decreased by more than 10 percentage points to 18.1% between 1995 and 2005, in connection with privatization, and it fluctuated around this value until 2020. The role of the public sector is irreplaceable in ensuring internal and external security and in the implementation of social security. The role of the public sector in the education sector is very strong (over 90% of the added value created). The share in healthcare was around 60% for a long time.

Table 1.4 Share of the public sector in gross value added created in individual sectors and in the national economy, 1995-2020, %

	1995	2000	2005	2010	2015	2020
TOTAL	29,6	20,1	18,1	18,4	17,4	18,8
A Agriculture, forestry and fishing	7,6	5,6	5,9	12,1	13,4	2,4
B Mining and quarrying	65,4	31,4	15,5	16,4	17,8	26,1
C Manufacturing	22,3	3,7	1,9	0,8	0,7	0,6
D Electricity, gas, steam and air conditioning supply	81,0	67,4	56,6	49,0	52,1	51,8
E Water supply; sewerage, waste management and remediation activities	42,2	16,6	18,8	20,1	32,9	38,8
F Construction	1,9	1,0	0,4	1,0	0,5	0,6
G Wholesale and retail trade; repair of motor vehicles and motorcycles	6,5	0,6	0,3	0,2	:	:
H Transportation and storage	50,2	47,8	41,6	48,3	44,9	42,6
I Accommodation and food service activities	3,9	1,3	2,0	2,5	2,2	3,6
J Information and communication	45,9	31,7	1,8	4,8	4,3	3,0
K Financial and insurance activities	38,6	6,6	6,4	3,7	1,7	2,3
L Real estate activities	7,1	5,2	3,1	2,2	2,8	2,6
M Professional, scientific and technical activities	13,7	13,1	9,4	11,7	13,9	11,4
N Administrative and support service activities	2,5	1,8	1,8	3,0	5,7	5,0
O Public administration and defence; compulsory social security	100,0	100,0	100,0	100,0	100,0	100,0
P Education	93,8	93,2	91,6	89,3	90,2	91,3
Q Human health and social work activities	66,7	58,5	59,2	59,6	58,3	62,0

R Arts, entertainment and recreation	34,2	29,8	32,1	33,8	35,2	44,1
S Other service activities	3,2	2,6	4,2	4,2	2,5	2,1

Source: CZSO Database of Annual National Accounts, Table M000105b; data as of 22 June 2023.

On the contrary, the share of gross value added in the national private sector gradually decreased from the initial 56% in 1995 to the final 43% in 2010 between 1995 and 2010. It fluctuated around this value in the period from 2010 to 2020. The share was significantly reduced in the financial and insurance activities (from 51% in 1995 to 8% in 2020), manufacturing (from 66% in 1995 to 41% in 2020), water supply; sewage, waste management and remediation activities (from 54% to 31%) and professional, scientific and technical activities sectors (from 81% to 65%). Construction remains the domain of the national private sector: almost 90% of gross value added in the construction sector was created in the possession of national private capital in 2020.

Table 1.5 Share of the national private sector in gross value added created in individual sectors and in the national economy, 1995-2020, %

	1995	2000	2005	2010	2015	2020
TOTAL	56,3	55,7	48,7	43,0	42,6	44,4
A Agriculture, forestry and fishing	92,2	93,8	92,2	84,1	83,1	94,5
B Mining and quarrying	33,6	63,8	78,3	60,8	33,7	57,1
C Manufacturing	66,4	60,0	49,3	41,3	39,7	41,4
D Electricity, gas, steam and air conditioning supply	18,9	23,1	13,1	24,9	24,9	22,6
E Water supply; sewerage, waste management and remediation activities	54,4	63,4	48,1	44,9	27,9	30,8
F Construction	94,8	93,0	83,3	83,6	87,1	89,7
G Wholesale and retail trade; repair of motor vehicles and motorcycles	82,0	76,1	64,1	62,9	60,3	60,8
H Transportation and storage	48,5	47,0	47,2	31,8	37,2	37,3
I Accommodation and food service activities	90,6	87,7	86,5	85,6	80,5	86,5
J Information and communication	47,4	55,6	60,3	30,0	49,0	53,8
K Financial and insurance activities	51,4	51,0	16,4	6,8	7,7	8,2
L Real estate activities	91,4	91,2	89,2	87,1	85,1	88,7
M Professional, scientific and technical activities	81,3	73,9	73,4	66,5	62,4	65,0
N Administrative and support service activities	90,6	81,8	70,7	67,1	61,5	57,0
O Public administration and defence; compulsory social security	:	:	:	:	:	:
P Education	5,6	6,5	8,1	10,2	9,4	8,2
Q Human health and social work activities	33,2	41,1	39,2	37,6	38,7	35,5
R Arts, entertainment and recreation	65,1	67,4	65,2	63,8	56,9	49,7
S Other service activities	96,6	95,7	93,3	90,1	88,6	92,9
T Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	100,0	100,0	100,0	100,0	100,0	100,0

Source: CZSO Database of Annual National Accounts, Table M000105b; data as of 22 June 2023.

The share of added value created in the foreign-controlled sector has the opposite development, as it increased from 5% in 1995 to 29% in 2010 (it remained around this value until 2020). The highest share of value added is in the financial and insurance activities sector, where foreign-controlled institutions generate almost 90% of the sector's gross value added. Manufacturing follows with 58% and information and communication is above 40% (43%).

Table 1.6 Share of the foreign-controlled sector in gross value added created in individual sectors and in the national economy, 1995-2020, %

	1995	2000	2005	2010	2015	2020
TOTAL	5,0	15,3	23,6	29,0	30,1	27,8
A Agriculture, forestry and fishing	0,2	0,6	1,9	3,8	3,5	3,1
B Mining and quarrying	1,0	4,8	6,2	22,8	48,5	16,8
C Manufacturing	11,3	36,3	48,8	57,9	59,6	58,0
D Electricity, gas, steam and air conditioning supply	0,1	9,5	30,3	26,1	23,0	25,6
E Water supply; sewerage, waste management and remediation activities	3,4	20,0	33,1	35,0	39,2	30,4
F Construction	3,3	6,0	16,3	15,4	12,4	9,7
G Wholesale and retail trade; repair of motor vehicles and motorcycles	11,5	23,3	35,6	36,9	39,7	39,2
H Transportation and storage	1,3	5,2	11,2	19,9	17,9	20,1
I Accommodation and food service activities	5,5	11,0	11,5	11,9	17,3	9,9
J Information and communication	6,7	12,7	37,9	65,2	46,7	43,2
K Financial and insurance activities	10,0	42,4	77,2	89,5	90,6	89,5
L Real estate activities	1,5	3,6	7,7	10,7	12,1	8,7
M Professional, scientific and technical activities	5,0	13,0	17,2	21,8	23,7	23,6
N Administrative and support service activities	6,9	16,4	27,5	29,9	32,8	38,0
O Public administration and defence; compulsory social security	:	:	:	:	:	:
P Education	0,6	0,3	0,3	0,5	0,4	0,5
Q Human health and social work activities	0,1	0,4	1,6	2,8	3,0	2,5
R Arts, entertainment and recreation	0,7	2,8	2,7	2,4	7,9	6,2
S Other service activities	0,2	1,7	2,5	5,7	8,9	5,0

Source: CZSO Database of Annual National Accounts, Table M000105b; data as of 22 June 2023.

The next section (Table 1.7) will focus on the development of the share of value added in production. The total share of gross value added in production was around 40% for a long time. It is decreasing in agriculture, forestry and fishing (from 44% in 1995 to 35% in 2020), in mining and quarrying (from 52% to 42%) and it slightly decreased in manufacturing between 1995 and 2005 (from 29.7% to 26.5%). The high share of the manufacturing industry in the production of the Czech economy is the reason for the relatively low share of gross value added in total production.

The share of gross value added created in production also decreases in other sectors: in transportation and storage from 49% in 1995 to 39% in 2010, in accommodation and food service activities from 57% in 1995 to 41% in 2021. In contrast, the share is growing in the education sector (from 72% in 1995 to 83% in 2021) or in the human health and social work activities (from 56% in 1995 to 66% in 2021). In the case of education, this development is related to the fact that it is largely a nonmarket sector and the increase in the share of gross value added is primarily due to the increase in the salaries of teachers and other employees in education. Rising wages and salaries of health professionals play a role also in healthcare.

We can also see further growth in information and communication (from 48% in 1995 to 61% in 2021).

Table 1.7 Share of gross value added in production, current prices, 1995-2020, %

NACE	1995	2000	2005	2010	2015	2020	2021
TOTAL	41,8	40,9	39,6	39,0	39,2	42,3	41,0
A Agriculture, forestry and fishing	44,4	44,0	44,0	33,9	38,8	37,7	35,3
B Mining and quarrying	52,1	47,9	50,8	50,7	52,7	45,6	42,4
C Manufacturing	29,7	29,8	26,5	26,0	26,7	27,6	26,3
D Electricity, gas, steam and air conditioning supply	42,0	28,3	33,6	38,1	37,1	49,7	41,8
E Water supply; sewerage, waste management and remediation activities	42,5	38,2	41,2	38,3	37,1	37,2	35,7
F Construction	31,7	28,5	30,1	30,3	30,1	30,7	29,8
G Wholesale and retail trade; repair of motor vehicles and motorcycles	48,4	51,9	52,3	46,7	49,8	51,3	49,4
H Transportation and storage	49,3	50,5	46,2	39,4	37,5	40,1	39,3
I Accommodation and food service activities	56,8	56,1	55,3	48,3	46,0	42,1	41,1
J Information and communication	47,9	48,6	51,2	51,9	53,8	60,9	60,5
K Financial and insurance activities	50,6	46,3	42,3	53,0	52,9	55,1	51,7
L Real estate activities	50,5	54,1	55,3	52,8	53,6	55,4	54,0
M Professional, scientific and technical activities	45,5	39,5	41,1	37,6	42,2	46,7	48,4
N Administrative and support service activities	41,4	40,4	40,9	42,2	37,5	40,7	41,0
O Public administration and defence; compulsory social security	65,4	65,2	64,3	65,1	68,8	69,1	69,7
P Education	72,2	75,1	75,5	75,5	77,2	83,5	82,9
Q Human health and social work activities	56,2	59,9	62,0	59,7	61,9	65,1	65,5
R Arts, entertainment and recreation	44,1	42,2	43,9	40,3	41,4	43,2	46,6
S Other service activities	60,6	53,7	50,0	59,5	56,2	56,3	55,9

Source: Own calculation according to the CZSO data (Database of National Accounts, Tables M000102a and M000104a); data as of 22 June 2023.

We can compare the share of gross value added in production in individual sectors of the national economy between public non-financial enterprises, private non-financial enterprises and foreign-controlled enterprises in the next section (Table 1.8). We will do so for the last 'pre-COVID-19' year 2019.

The gross value added created in the non-financial enterprises sector amounts to approximately one third of the total production (33.9%). This share is the highest in national public enterprises (48.8%) and it is the lowest in foreign-controlled enterprises (30.1%). The value of the share in national private enterprises is slightly above average (36.9%). Naturally, the average values are affected by a different sectoral structure, so it is more appropriate to compare the values of the share of gross value added in production within the same sector, but between individual subsectors (i.e. 'in rows').

In forestry, the share is the highest in foreign-controlled enterprises (38.0%), while it is less than ten percent (9.7%) in national public enterprises. We can see a significant difference between national and foreign enterprises in the tobacco industry (66.6% in foreign, 40.8% in national private) and also in the chemical industry (49.1% in national public enterprises, 28.6% in national private and only 13.1% in foreign-controlled enterprises).

The lower share of value added in production is in the manufacture of computer, electronic and optical products (50.4% public, 60.7% national private and only 15.2% foreign), in the manufacture of electrical equipment (about 40% national public and national private, 28.1% foreign), in the manufacture of machinery and equipment n.e.c. (where the numbers are similar) and then in the significant automotive industry (27.7% national private vs 20.5% foreign-controlled). The differences may be related to two phenomena. Firstly, it is a higher share of intermediate consumption in the form of purchasing in-house services, including licence fees paid to parent companies; secondly, it is a lower valuation of production and added value, when products are not intended for the end user, but are sold as subcontracts within an international holding. Both of these phenomena have an unpleasant impact on employees: because added value is an essential source for payment of wages and salaries (these are the compensation of employees in the concept of national accounts), a lower share of added value in production may lead to wages and salaries of Czech employees lagging behind compared to their colleagues working in the same sectors abroad.

Table 1.8 Share of gross value added in production by sectors and institutional sectors of the non-financial enterprises sector, current prices, 2019, %

NACE	Total non-financial enterprises	National public	National private	Foreign-controlled
TOTAL	33,9	48,8	36,9	30,1
01 Crop and animal production, hunting and related service activities	31,9	36,4	32,2	27,8
02 Forestry and logging	21,6	9,7	25,1	38,0
03 Fishing and aquaculture	39,2	n/a	39,1	62,5
05 Mining of coal and lignite	45,4	49,2	38,4	65,9
06 Extraction of crude petroleum and natural gas	94,9	n/a	95,2	69,8
07 Mining of metal ores	55,3	55,3	n/a	n/a
08 Other mining and quarrying	40,1	42,3	42,1	38,5
09 Mining support service activities	46,7	n/a	49,7	34,1
10 Manufacture of food products	23,2	n/a	22,8	24,2
11 Manufacture of beverages	36,9	38,4	31,6	39,8
12 Manufacture of tobacco products	66,4	n/a	40,8	66,6
13 Manufacture of textiles	30,2	n/a	31,4	28,7
Manufacture of wearing apparel	41,9	n/a	42,3	41,0
15 Manufacture of leather and related products	48,3	n/a	44,6	61,0
16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	30,5	66,7	31,2	29,6
17 Manufacture of paper and paper products	28,8	n/a	28,7	28,8

18 Printing and reproduction of recorded media	33,6	46,7	35,3	26,4
19 Manufacture of coke and refined petroleum products	14,2	n/a	14,8	13,0
20 Manufacture of chemicals and chemical products	16,9	49,1	28,6	13,1
21 Manufacture of basic pharmaceutical products and pharmaceutical preparations	36,7	10,0	45,4	34,5
22 Manufacture of rubber and plastic products	31,4	n/a	35,5	29,8
23 Manufacture of other non-metallic mineral products	37,2	n/a	39,0	36,5
24 Manufacture of basic metals	17,9	n/a	19,2	16,6
25 Manufacture of fabricated metal products, except machinery and equipment	34,2	47,9	36,9	30,7
26 Manufacture of computer, electronic and optical products	19,8	50,4	60,7	15,2
27 Manufacture of electrical equipment	30,3	40,0	40,2	28,0
28 Manufacture of machinery and equipment n.e.c.	31,6	42,0	38,0	28,1
29 Manufacture of motor vehicles, trailers and semi-trailers	20,8	n/a	27,7	20,5
30 Manufacture of other transport equipment	34,8	n/a	37,4	32,7
31 Manufacture of furniture	32,4	43,1	33,9	28,0
32 Other manufacturing	38,7	n/a	42,6	36,2
33 Repair and installation of machinery and equipment	39,1	35,1	40,9	36,6
35 Electricity, gas, steam and air conditioning supply	36,6	44,6	44,2	26,2
36 Water collection, treatment and supply	39,4	56,0	23,8	29,4
37 Sewerage	50,7	53,9	44,9	63,8
38 Waste collection, treatment and disposal activities; materials recovery	31,8	51,2	27,5	31,3
39 Remediation activities and other waste management services	29,4	9,0	41,3	27,4
41 Construction of buildings	20,2	53,2	20,5	16,9
42 Civil engineering	23,5	32,4	27,4	17,8
43 Specialised construction activities	30,4	41,6	30,5	27,7
45 Wholesale and retail trade and repair of motor vehicles and motorcycles	44,7	50,0	43,5	47,2
46 Wholesale trade, except of motor vehicles and motorcycles	49,6	56,4	48,9	50,6
47 Retail trade, except of motor vehicles and motorcycles	53,2	62,3	52,0	54,1
49 Land transport and transport via pipelines	39,9	55,8	34,1	38,0
50 Water transport	29,4	n/a	32,6	13,7
51 Air transport	10,3	n/a	10,3	9,8
52 Warehousing and support activities for transportation	29,5	62,3	25,5	25,6
53 Postal and courier activities	45,6	71,5	23,4	25,2
55 Accommodation	43,7	57,3	42,4	47,0
56 Food and beverage service activities	42,9	30,8	43,3	41,2
58 Publishing activities	57,2	37,5	57,5	56,7

59 Motion picture, video and television programme production, sound recording and music publishing activities	34,5	n/a	38,4	21,0
60 Programming and broadcasting activities	50,7	28,6	30,4	56,9
61 Telecommunications	49,7	49,1	43,2	57,3
62 Computer programming, consultancy and related activities	69,5	74,7	67,6	71,3
63 Information service activities	61,	57,0	67,3	53,5
64 Financial service activities, except insurance and pension funding	n/a	n/a	n/a	n/a
65 Insurance, reinsurance and pension funding, except compulsory social security	n/a	n/a	n/a	n/a
66 Activities auxiliary to financial services and insurance activities	n/a	n/a	n/a	n/a
68 Real estate activities	46,6	47,9	42,0	55,3
69 Legal and accounting activities	55,2	8,1	54,3	56,9
70 Activities of head offices; management consultancy activities	41,2	45,5	32,8	48,6
71 Architectural and engineering activities; technical testing and analysis	41,9	38,9	40,3	47,0
72 Scientific research and development	49,9	59,9	49,2	48,2
73 Advertising and market research	25,8	40,0	24,9	26,9
74 Other professional, scientific and technical activities	29,5	60,0	29,9	27,9
75 Veterinary activities	42,9	n/a	42,9	43,3
77 Rental and leasing activities	54,1	97,9	47,9	57,7
78 Employment activities	22,3	n/a	21,2	24,6
79 Travel agency, tour operator and other reservation service and related activities	8,9	3,8	8,6	10,0
80 Security and investigation activities	49,4	n/a	47,9	56,8
81 Services to buildings and landscape activities	36,5	30,3	39,8	35,0
82 Office administrative, office support and other business support activities	43,4	47,9	31,9	52,1
84 Public administration and defence; compulsory social security	n/a	n/a	n/a	n/a
85 Education	50,5	71,6	51,9	39,4
86 Human health activities	61,5	61,0	62,4	54,3
87 Residential care activities	54,	52,8	54,3	51,3
88 Social work activities without accommodation	58,2	n/a	58,1	60,7
90 Creative, arts and entertainment activities	21,7	26,3	21,6	21,4
91 Libraries, archives, museums and other cultural activities	63,2	66,7	61,2	66,6
92 Gambling and betting activities	41,5	n/a	36,5	58,9
93 Sports activities and amusement and recreation activities	27,2	19,8	29,8	7,2
94 Activities of membership organisations	39,6	n/a	39,7	27,3
95 Repair of computers and personal and household goods	42,5	n/a	46,0	38,9
96 Other personal service activities	49,5	55,3	48,9	52,3

97 Activities of households as employers of domestic personnel	n/a	n/a	n/a	n/a
98 Undifferentiated goods- and services-producing activities of private households for own use	n/a	n/a	n/a	n/a
99 Activities of extraterritorial organisations and bodies	n/a	n/a	n/a	n/a

Source: Own calculation according to the CZSO data (Database of National Accounts – Tables B001101d19, B011101d19, B011201d19 and B011301d19); data as of 22 June 2023.

1.2 Gross domestic product and other aggregates of national accounts

Another phenomenon related to the operation of foreign companies is the outflow of primary income (including in particular compensation of employees and property income) abroad. Primary incomes with foreigners (with non-residents) form the difference between gross domestic product and gross national income.

Table 1.9 shows the development of key indicators in the sequence of national accounts, from gross domestic product through the balance of net primary income with non-residents to gross national income, which is already very similar to gross national disposable income (although the value of current transfers with non-residents increases quite a bit over time). Gross disposable income is then an essential source of financing for both final consumption expenditure and gross capital formation.

Table 1.9 Income, expenses and capital transfers, 1995–2021, millions of CZK, current prices

Name	1995	2000	2005	2010	2015	2020	2021
Gross domestic product	1 596 306	2 386 289	3 285 601	3 992 870	4 625 378	5 709 131	6 108 717
Primary income - from non-residents	37 948	87 588	129 924	127 589	192 609	253 170	291 992
Primary income - to non-residents	50 393	133 999	281 728	426 511	509 838	537 837	541 784
Net primary income from non-residents(+)/to non-residents(-)	- 12 445	- 46 411	- 151 804	- 298 922	- 317 229	- 284 667	- 249 792
Gross national income	1 583 861	2 339 878	3 133 797	3 693 948	4 308 149	5 424 464	5 858 925
Current transfers - from non-residents	14 272	18 834	50 130	54 984	73 880	90 613	98 093
Current transfers - to non-residents	6 636	18 317	66 982	83 788	108 128	153 646	169 235
Net current transfers from non-residents(+)/to non-residents(-)	7 636	517	- 16 852	- 28 804	- 34 248	- 63 033	- 71 142
Gross disposable income	1 591 497	2 340 395	3 116 945	3 665 144	4 273 901	5 361 431	5 787 783
Final consumption expenditure	1 099 777	1 668 447	2 238 161	2 778 360	3 056 212	3 830 670	4 081 890
Balance of the change in net equity of households in pension fund reserves with non-residents	:	:	:	:	75	227	234
Gross national savings	491 720	671 948	878 784	886 784	1 217 614	1 530 534	1 705 659
Gross capital formation	545 466	762 331	970 935	1 092 444	1 294 331	1 493 139	1 845 920
Current external balance	- 53 746	- 90 383	- 92 151	- 205 660	- 76 717	37 395	- 140 261
Capital transfers - from non-residents	308	714	8 374	72 929	134 365	72 559	83 297
Capital transfers - to non-residents	129	241	21 899	3 725	6 160	8 142	12 716
Net acquisition of non-produced non-financial assets from non-residents(+)/to non-residents(-)¹⁾	621	916	297	- 8 051	2 072	- 2 751	- 14 176
Net capital transactions from non-residents(+)/to non-residents(-)	- 442	- 443	- 13 822	77 255	126 133	67 168	84 757
Net lending(+)/borrowings	- 54 188	- 90 826	- 105 973	- 128 405	49 416	104 563	- 55 504
Consumption of fixed capital	331 572	523 097	650 536	835 792	957 235	1 228 686	1 302 062
Net domestic product	1 259 021	1 855 053	2 625 995	3 146 510	3 658 189	4 480 445	4 806 655
Net national income	1 246 576	1 808 642	2 474 191	2 847 588	3 340 960	4 195 778	4 556 863
Net disposable income	1 254 212	1 809 159	2 457 339	2 818 784	3 306 712	4 132 745	4 485 721
Net national savings	154 435	140 712	219 178	40 424	250 425	301 848	403 597

Source: CZSO Database of National Accounts, Table M000140a; data as of 22 June 2023.

Using Table 1.9, we can calculate selected ratio indicators; they are presented in Table 1.10. Primary income to non-residents (property income and compensation of employees) accounted for about 10% of all primary income, while primary income received from non-residents had gradually increased, but was still below 5% in 2021. This means that the net primary income balance to non-residents is negative. It reached over seven percent in the pre-COVID-19 years, it decreased slightly in the COVID-19 years 2020 and 2021 due to restrictions on dividend payments abroad. This means that gross national income is also more than seven percent (-7.49%) lower than the gross domestic product (2010), which is one of the highest among EU countries (Luxembourg with a high share of daily commuters and Ireland with an extremely high share of foreign investment being the top two). Foreign direct investment in itself is not harmful, but it is necessary to consider the impact on the relationship between gross domestic product and other macroeconomic aggregates. The source for financing final consumption and investment (fixed capital formation) is not the gross domestic product, but the gross national income derived from it and subsequently the gross disposable income[1].

Table 1.10 Income, expenditure and capital transfers, 1995–2021, selected ratios, %

Name	1995	2000	2005	2010	2015	2020	2021
Primary income - from non-residents (% of GDP)	2,38	3,67	3,95	3,20	4,16	4,43	4,78
Primary income - to non-residents (% of GDP)	3,16	5,62	8,57	10,68	11,02	9,42	8,87
Net primary income from non-residents(+)/to non-residents(-) (% of GDP)	-0,78	-1,94	-4,62	-7,49	-6,86	-4,99	-4,09
Gross national income (% of GDP)	99,22	98,06	95,38	92,51	93,14	95,01	95,91
Current transfers - from non-residents (% of GNI)	0,90	0,80	1,60	1,49	1,71	1,67	1,67
Current transfers - to non-residents (% of GNI)	0,42	0,78	2,14	2,27	2,51	2,83	2,89
Net current transfers from non-residents(+)/to non-residents(-) (% of GNI)	0,48	0,02	-0,54	-0,78	-0,79	-1,16	-1,21
Gross disposable income (% of GNI)	100,48	100,02	99,46	99,22	99,21	98,84	98,79
Final consumption expenditure (% of GDI)	69,10	71,29	71,81	75,80	71,51	71,45	70,53
Gross national savings (% of GDI)	30,90	28,71	28,19	24,20	28,49	28,55	29,47
Gross capital formation (% of GNS)	110,93	113,45	110,49	123,19	106,30	97,56	108,22
Savings rate (GNS / GDP)	30,80	28,16	26,75	22,21	26,32	26,81	27,92
Investment rate (GFCF / GDP)	34,17	31,95	29,55	27,36	27,98	26,15	30,22

Source: Own calculations based on CZSO data (Database of National Accounts, Table M000140a); data as of 22 June 2023.

The balance of net current transfers to non-residents deteriorates in tenths of a percent, reaching -1.21% of gross national income in 2021. The share of final consumption expenditure in gross disposable income is stable at slightly above 70% (the exception was the 'crisis' year 2010 when a number of planned investments in all sectors of the national economy were 'shock'-suspended), which corresponds to the stable share of gross national savings in gross disposable income (slightly below 30%, again with the exception of 2010). The total

[1] Cf. e.g. Fischer, J. VŠE o… významu hrubého národního důchodu. HN, 5. 4. 2018. Online: https://archiv.hn.cz/c1-66099830-vse-o-vyznamu-hrubeho-narodniho-duchodu.

investment rate, expressed as the ratio of gross capital formation and gross domestic product, is above the value of the savings rate, expressed as the ratio of gross national savings and GDP, over the entire reporting period. This simply leads to the financing needs (also referred to as net borrowing) when domestic resources (of households and financial institutions) are not enough to cover the investment needs of non-financial enterprises and government institutions.

1.3 Gross domestic product by region

Finally, let's look at two tables of regional GDP breakdown. Table 1.11 shows the development of regional GDP compared to 1995. Overall, gross domestic product in the Czech Republic increased by 82.1%, but the development in individual regions of the Czech Republic was very uneven. While the GDP grew by 147% and 137% in the capital city of Prague and the Central Bohemian Region respectively, it grew by only 22% and 24% in the Ústí nad Labem and Moravian-Silesian Regions respectively in 26 years. The real value of GDP generated in the Karlovy Vary Region in 2021 was 5.5% lower than in 1995. If we were to measure the economic development of the regions only using GDP (which is very simplified[2]), we would find that the Karlovy Vary Region experienced an overall economic decline over the past 26 years.

Table 1.11 Gross domestic product in the regions of the Czech Republic, 1995=100, volume indices

Territory	1995	2000	2005	2010	2015	2020	2021
Czech Republic	100,0	109,0	132,0	149,2	162,3	175,9	182,1
Capital City of Prague	100,0	123,0	164,1	191,0	212,9	235,5	246,8
Central Bohemian Region	100,0	119,5	146,1	180,4	203,3	229,7	236,5
South Bohemian Region	100,0	107,9	126,2	128,0	131,9	143,9	144,0
Plzeň Region	100,0	105,8	130,5	146,6	158,8	166,7	173,7
Karlovy Vary Region	100,0	96,7	102,5	99,8	98,7	95,5	94,5
Ústí nad Labem Region	100,0	95,1	107,2	117,2	122,0	120,3	121,8
Liberec Region	100,0	107,1	123,3	133,9	145,7	155,5	156,8
Hradec Králové Region	100,0	111,1	127,0	141,1	151,1	174,0	183,7
Pardubice Region	100,0	105,5	123,4	147,0	155,8	176,5	177,4
Vysočina Region	100,0	110,3	134,7	145,7	155,5	169,1	165,2

[2] For example, in terms of the standard of living of households, the relationship between gross domestic product and other aggregates applies here again. Just as the gross domestic product is higher than the gross national income at the national level (due to the outflow of primary income), the situation in the Karlovy Vary Region will probably be the opposite (residents of the Karlovy Vary Region earn money in the nearby border region). The significant lagging of the Karlovy Vary Region in terms of GDP may not lead to a (so strong) lagging of the standard of living of households living in the area.

South Moravian Region	100,0	105,0	125,6	146,3	163,4	179,9	188,2
Olomouc Region	100,0	104,0	119,9	133,2	146,1	161,1	166,4
Zlín Region	100,0	105,4	129,0	156,1	168,7	180,7	189,4
Moravian-Silesian Region	100,0	97,1	109,9	112,0	117,5	116,7	124,2

Source: CZSO regional accounts, Table REG_HDP_SC_V; data as of 22 June 2023.

Using Table 1.12, we can make a comparison from a different perspective, by comparing the gross domestic product per capita adjusted for the effect of price differences using the purchasing power standard (PPS) model. However, there is a clear divergence among regions also in this case. The Czech Republic as a whole converges with the EU average (which is also due to its gradual enlargement to include poorer member states), namely from 77.9% of the EU average in 1995 to 91.6% of the EU average in 2021. The situation is different in individual regions. But the key finding is that while more advanced regions are even more advanced (an increase in the capital city of Prague from 132.5% in 1995 to 202.9% in 2021), the Karlovy Vary Region fell from 74.2% in 1995 to 54.5% in 2021 and the Ústí nad Labem Region from 74.6% in 1995 to 63.5% in 2021. This is probably the effect of the area bordering a more developed country because we do not observe this trend in the Moravian-Silesian Region (the region converges).

Table 1.12 Gross domestic product per capita in PPS, EU27 = 100

Territory	1995	2000	2005	2010	2015	2020	2021
Czech Republic	77,9	73,2	82,0	84,4	88,6	93,4	91,6
Capital City of Prague	132,5	144,3	181,0	191,7	197,0	205,3	202,9
Central Bohemian Region	71,6	73,1	76,1	74,5	79,1	81,7	79,4
South Bohemian Region	74,6	68,9	73,1	69,5	71,1	76,6	72,7
Plzeň Region	75,2	68,5	76,4	76,8	81,0	81,8	80,9
Karlovy Vary Region	74,2	62,7	62,0	59,2	58,1	57,4	54,5
Ústí nad Labem Region	74,6	60,7	65,6	64,9	66,3	65,6	63,5
Liberec Region	72,3	66,9	68,1	63,6	68,0	70,7	67,7
Hradec Králové Region	71,6	68,1	70,2	70,8	75,3	84,1	83,8
Pardubice Region	68,9	62,4	65,4	67,2	70,1	76,5	72,7
Vysočina Region	64,8	60,3	67,2	66,7	71,7	78,5	73,9
South Moravian Region	72,6	66,1	72,8	78,9	84,0	91,0	90,2
Olomouc Region	65,3	58,1	60,0	62,1	67,1	74,0	72,7
Zlín Region	65,6	59,7	65,3	69,5	75,4	78,7	77,8
Moravian-Silesian Region	67,8	56,5	67,3	68,3	72,4	71,8	72,8

Source: CZSO regional accounts, Table REG_HDP_PPS; data as of 22 June 2023.

2. Historical and social context of the Czech labour market

The second chapter describes the historical development of the introduction of technologies into industrial production and their impact on the labour market. Gradually, it shows that the current digital revolution is only one phase of a long-term process to which employees and employers have always been able to adapt in a timely manner. The uniqueness of the current situation lies in the fact that the currently emerging technologies affect all groups of employees at the same time in a relatively short period of time and that they meet with the currently ongoing flexibilization of the labour market.

2.1 Historical view of technology deployment

The very emergence of industrial production in the 19th century is associated with the massive introduction of technology. The invention of the weaving machine in 1785 initiated the concentration of production from home workshops and small manufactories into giant factories of today's style. There were protests of the Luddites already at the beginning of the 19th century, associated with the breaking of machines that took people's jobs.

From a sociological point of view, society is undergoing rapid changes in this period. The population is concentrated in fast-growing cities (**urbanization**) that are not ready for the influx of workers and their families. They are rapidly building emergency workers' colonies and communal walkways flats that are not suitable either in terms of health, safety or the dignity of human life. There is a break in broader family ties (**individualization**) and the detachment of new generations from previously ordinary multigenerational households. The invention of the steam engine (see below) and the introduction of rail transport led to an expanding **emancipation** from the place of origin; everyone was suddenly able to get quickly and cheaply to where they would not be able to walk.

From the point of view of work, the qualification of the labour is gradually reduced (**deskilling**). The original craftsman – an artist who was able to make a whole shoe from a piece of leather - is demoted to a factory worker specialized in one partial task, e.g. cutting out one part of a shoe from leather rapidly moving along the production line.

Retrospectively, the development of industrial production described in the previous paragraphs is referred to as the **First Industrial Revolution**. It is therefore characterized by the introduction of the first machines and the emergence of the first larger factories. Water took care of the propulsion of the machines in the first phase and rapidly expanding steam engines from the middle of the 19th century. Socially, there were large geographical and social movements of the population, an increase in dependence on the owners of means of production.

The period at the end of the 19th century is referred to as the **Second Industrial Revolution**, when electricity is increasingly replacing the steam engine in the role of driving factory machines. Mass production[3] is introduced in production, leading to even greater specialization

[3] Henry Ford started mass car production in 1903. Tomáš Baťa visited his factories already in 1905 and was fascinated by the speed and accuracy of the workers if they specialize in one

and deskilling of the workforce. From a social point of view, larger organizational units are created – the formation of national states, political parties in the current concept, interest associations (Sokol, Junák) and trade unions. Increasingly wider classes of the population receive civil and political rights.

The **Third Industrial Revolution** dates back to the late 1960s. The advent of microprocessor computing and international transport is taking place in production. The economy is undergoing two major transitions. First, there was a gradual decline in agriculture after the Second World War. Large masses of the population engaged in primary agricultural production were replaced by powerful mechanization over the course of about ten years. After a short retraining, the free workforce was used in rapidly developing industrial production. The second transition took place at the turn of the 1960s and 1970s when industrial production in Western countries declined due to the transfer of a large part of production to countries with cheap labour. The free workforce gradually moved into the emerging service sector (Breen 2004).

A strong generation of children born after World War II, who were just reaching the age of majority, began to find employment. While the countries of the then Capitalist Bloc strengthened the capacities of universities to accommodate the exceptionally strong generation, the countries of the then Socialist Bloc let the strong generation enter the labour market and start their own families[4]. A number of cultural, sexual and anti-capitalist revolutions are taking place, especially in Western countries. There is the second crisis of modernity (Wagner 2008), which is characterized in the economic field by the gradual dismantling of large organizations and their transformation into flexible networks of mutually cooperating smaller units. This is where the general pressure for flexibility begins, which will be discussed later.

The events we are witnessing these days are referred to as the **Fourth Industrial Revolution**. It is no longer characterized by the introduction of machines, factory production or control of steam power (the 1st Industrial Revolution), the introduction of electricity (the 2nd Industrial Revolution) or computers (the 3rd Industrial Revolution). On the other hand, it refers to the development of telecommunications (especially the Internet), robotics and the emergence of artificial intelligence.

2.2 Education vs technology in the labour market

The importance of education on the labour market grew along with industrialization. Both economic (Becker 1964, Mazouch and Fischer 2011) and sociological (Blau, Duncan 1967) theories show that education brings higher financial and non-financial rewards in the labour market and beyond in modern industrial societies. Rewards on the labour market may take the form of a higher salary or wage, a lower risk of unemployment, a more prestigious or creative occupation. The positive impact of higher education on state of health and life expectancy, a sense of subjective happiness and better options when choosing a partner are often shown outside the labour market (Hout 2012). From the point of view of society, it makes sense to invest in the capacity of the education system, especially because higher

specific, simple and easily described task. He then introduced a similar system in his Czech shoe factories.

[4] Hence, other strong generation born since the early 1970s, incorrectly referred to as Husák's Children.

education of the population leads to the generation of higher GDP, lower spending on health care, lower tendency of the population to populist and extremist parties and other positive phenomena (Mazouch and Fischer 2011).

As already mentioned above, there was a significant increase in the number of people completing secondary education at the beginning of the 1970s[5]. These people entered the labour market or started families in the countries of the then Socialist Bloc, in which they were supported by a loan system and massive housing construction. But in Western countries they entered universities to a large extent, which had to increase their capacities accordingly. This provoked a storm of resentment and fear among the academics of the time (Bourdieu, Passeron 1990), who logically deduced the inevitable inflation of diplomas from economic laws. If there is a surplus of certain goods in a market, they said, there must necessarily be a forced reduction in its price according to the law of supply and demand. If double the number of university-educated employees enter the labour market, the value of their diplomas must necessarily decrease. Thus, universities unnecessarily spend funds on the education of future unemployed or, at best, overqualified employees.

However, no statistics in the 1980s showed that the unemployment of graduates increased significantly or that they might have a job that did not match their skills. A closer examination of the labour market found that the labour market absorbed a much higher number of university students without problems. It underwent a structural transformation (see the section on the Third Industrial Revolution above).

Microprocessor computers began to be introduced into industrial production to a greater extent and a person with sufficient skills was necessary for their operation. The only social group that had at least some experience with computers were recent university graduates. Although they may not be employed directly in their field of study, they held at least a well-paid and highly financially and socially valued position associated with computer operation.

Sociologists (Card, Dinardo 2002) described this phenomenon using the skill-biased technological change theory. Persons with relevant skills, i.e. with higher skills, were generously rewarded by the labour market. On the contrary, people who lacked these skills were largely pushed out of the labour market. This was due to the continued introduction of machines capable of replacing simple work tasks and the transfer of simple production to countries with a cheaper workforce[6].

Yet the argument about knowledge of computer technology was becoming unsustainable in the 1990s. This knowledge also spread to other social classes and it certainly could not be said that a company needed a university graduate to operate a computer. Nevertheless, according to the then statistics, there was no significant inflation of university diplomas. The usual explanation is the further development of technologies (i.e. not necessarily computer technology) which changed the form of various occupations towards higher complexity and demands. Where a secondary school educated employee with simple tools used to be enough,

[5] For example, an average of 50,430 full-time students graduated in the Czech part of the then Czechoslovakia in the 1964/65–1974/75 school years. 127,554 people suddenly appeared before the graduation committee in 1975/76 and similarly high numbers continued (the average for 1975/76–1985/86 reached 121,625) (Čudová 1998).

[6] And also with lower legislative protection of employees, weaker role of trade unions, lower demands on environmental and social impacts of production, etc.

a university student with a laptop was now needed. In addition, there was a growing demand for people who knew international trade and logistics and were thus able to manage an increasingly complex system of global production.

Several simultaneous phenomena occurred at the beginning of the third millennium. The high return on higher levels of education on the labour market continued to persist. Certain people were also still being pushed out of Western labour markets. However, these were no longer exclusively people with the lowest skills (whose work could be transferred abroad or replaced by machines), but relatively educated and skilled employees, such as secretaries or bank officials. It turned out that the introduction of new technologies replaces not only simple manual activities, but also activities that are sufficiently routine and easy to algorithmize[7]. On the contrary, economists recorded a slight increase in income for the least skilled employees. Daniel Oesch (2013) showed that the labour market polarization is to blame. A wealthy class of highly skilled professionals need high-quality personal services[8] to live comfortably and are willing to pay for it. These are activities of a personal nature, which for the most part cannot be replaced by machines or moved to another country.

All these phenomena were later summarized by Goos, Manning and Salomons (2014) in the theory of task-biased technological change. According to it, high-skilled employees are still highly rewarded (although not only because of their knowledge of working with computer technology, but generally due to the increasing complexity of all occupations). Low-skilled people are still being pushed out of the labour market (due to the increasing use of machines, due to the relocation of part of production abroad), with the exception of employees in services. Furthermore, those whose work is routine, easy to describe and therefore programmable by increasingly advanced computers or robots are also being pushed out of the labour market.

This closes the circle that Henry Ford, Tomáš Baťa and other industrialists began at the beginning of the 20th century. Their dream of breaking down complex production into simple, well-described and easy-to-learn steps that can be explained to unskilled employees at no great cost and gradually 'train' them in their flawless and quick implementation has come to perfection. A number of activities are so simple and so well described that they can be explained not only to human employees, but also to robotic employees.

There are now basically two races run with developing robots and artificial intelligence – economic and algorithmic. Within the economic framework, it is a balancing of two curves, the rising price of (human) work, including all additional costs,[9] and the decreasing costs of

[7] The secretaries were thus, with a little exaggeration, replaced by automatic coffee machines and by the fact that each manager had a computer with a printer and a text editor on their desks; bank officials then largely suffered for the development of ATMs and online banking.

[8] These include restaurants, food delivery by couriers, services such as massages or cosmetics, shopping from home, but also professional care for children or parents. Most of these activities can be performed by an employee with minimal skills, but there is rarely a risk of replacement by a machine and moving to another country is practically impossible.

[9] Not only tax and other payments to the increasingly greedy welfare state, but also the cost of holidays, initial and periodic training, equipment for the workplace and its form, e.g. dimensional, light, etc.

acquiring and operating robots[10]. Within the algorithmic framework, it is all about what can be described as a routine, easily described work task. Due to the development of artificial intelligence in recent months, even occupations that were recently considered creative and definitely non-algorithmable are no longer safe from being replaced. We are therefore in a situation where, for the first time in human history, technology on the labour market does not create any new jobs, but attacks jobs stratified across the educational spectrum. Moreover, the development of technology is so fast that we can no longer talk about a simple technological change in the labour market, but we must use the stronger word technological turn (Doseděl 2021).

The individual phases of technology implementation were delayed or at least slowed down in the Czech Republic. However, we began to catch up with Western countries very quickly by joining the Western Bloc after the change in social conditions in November 1989. Thus, the introduction of computer technology in our country took place to a greater extent only in the 1990s; but the development of the Internet, robotics and artificial intelligence was already achieved in the same time frame as the rest of the world. Although the first educational expansion of the university level of the education system (in the 1970s) missed us, we also experienced a significant increase in the number of university students, especially after 2000, including social debates about the impending inflation of education (and their subsequent denial by many economic and sociological analyses). It can therefore be stated that we are currently in a period of technological turn, the Fourth Industrial Revolution and the strengthening of the service sector, as well as other countries of the former Western Bloc.

2.3 Flexibilization and precarization of work

Rapid digitalization in the labour market is faced with another important phenomenon, the continued strong pressure on the flexibility of workforce. As mentioned above, at least since the 1970s, we can talk about the fact that previously large organizations disintegrated into networks of smaller, cooperating units. And these networks change as needed. If one of the suppliers is not suitable, it may be replaced by another; this supplier may also choose between several customers. Both parties are guided by their current needs and possibilities. If the customer does not need the services or products of the supplier, they simply interrupt cooperation with the supplier. On the other hand, if they need a temporarily larger number of sub-products or services, they hire another supplier for this period, whose role may end after fulfilling the agreed obligations.

A similar situation full of uncertainty and pressure for flexibility prevails not only at the level of companies, but also at the level of their employees. It follows that if the employer is hired as needed for temporary contracts, it must transfer this uncertainty to its employees. It can only afford so many employees in a permanent employment for whom it is able to provide work. If there is a lack of contracts, it intervenes in the regular employees; of there is a temporary surplus of contracts, it hires additional employees for short-term or part-time work.

[10] Including savings in the form of smaller job demands, which do not need to meet the conditions of sufficient light, air supply, narrowly specified temperature, etc. for robots.

This creates a previously unprecedented class of employees who do not have a secure full-time job with an indefinite contract. The jobs that such employees must perform have been identified by various authors as flexible, atypical, non-standard, flexploitative (a combination of flexible and exploitative) or precarious.

In particular, the latter concept achieved great acclaim. The English sociologist and economist Guy Standing (2018) came up with it in 2011, pointing out in his books that it is a growing social class lacking basic security and achievements of the welfare state. In the area of work performance, they suffer from uncertainty of employment duration (i.e. contractually secured work for an indefinite period), uncertainty of the number of hours worked and remuneration (fixed working hours, clear system of bonuses and rewards), uncertainty in the employer (often agency employees or self-employed persons in false self-employment), uncertainty in access to non-financial benefits of employment (meal vouchers or discounts on meals, the right to leave, sick leave) as well as collective representation (impossibility of striking, being members of a trade union). According to Standing, these employees are denied basic civil rights and thus become second-class citizens.

Groups already disadvantaged in the labour market have a higher risk of a precarious occupation. These include fresh graduates (lacking the required experience to be gained in precarious employment) and older people (lack of digital skills, deteriorating physical performance and state of health), employees with lower education (their displacement from the labour market was discussed in the previous subchapter), women (caring role for children and aging parents), members of ethnic groups and migrants (cultural and language barriers, problems with nostrification of education) (Doseděl, Katrňák 2017).

Determining the share of employees performing precarious employment is problematic. First of all, it is difficult to precisely define the precariat. There are basically three approaches, but they all have their shortcomings. The first focuses on the characteristics of employment relationship and considers any employment that does not correspond to full-time employment for an indefinite period to be precarious. However, not every fixed-term contract and not every part-time contract must be involuntary and a sign of uncertainty on the labour market. The second approach tries to consider the possibility of employees taking advantage of non-financial benefits resulting from employment. But few research or statistics record whether an employee has access to discounted meals, sick leave or leave. The third approach tries to determine the feeling of insecurity resulting from employment from the employees themselves. However, they mentally suppress their unfavourable situation as part of coping strategies and rarely admit that their employment is precarious.

Depending on the definition and method of survey, various authors report precarization rates in European countries ranging from about 15 to 40% of the workforce. According to ILO statistics (2016), up to 20% of European employees work part-time, 11% have a fixed-term contract and 2.4% are hired for less than three months. We can estimate the share of precarious jobs in the Czech Republic according to the analyses of Doseděl and Katrňák (2017), who reached the range of 20 to 24% based on the characteristics of employment relationships, and in particular according to the Rozděleni svobodou (‘Divided by Freedom’) research (Prokop et al 2019) by Daniel Prokop’s team, according to which the deprived class accounts for about 17.6% of the Czech population.

2.4 Platform work

By combining both presented concepts, i.e. the ongoing digitalization of the labour market and the growing flexibilization and precarization of workforce, we come to a significant trend of recent years, the so-called platform work (also referred to as the gig economy). A growing proportion of employees work in a precarious job, very often as self-employed, using modern digital technologies.

A typical example of such a job is a courier or taxi driver. They no longer need to be employed in a larger company. They only have an agreement with an intermediary agency, often based abroad and doing business in the Czech Republic exclusively via the Internet, which offers them individual contracts. The agency takes care of promotion, running the reputation system by customers and service providers, often providing accounting or legal services. Of course, it collects the appropriate commission from its 'employees' (if this term can be used at all) for its services.

The employee manages their own working hours and earnings, acquires and maintains means of production at their own expense. They do not have any achievements of the welfare state or a labour movement. They cannot take legal leave; they simply do not work for part of the year and have no income. If they do not use commercial services to secure themselves, they do not have sickness insurance, they may also have problems with the allocation of a state pension in the necessary amount. They cannot use a strike as a repertoire to promote their own goals, a protest at the most.

Despite these disadvantages, platform work is on the rise in a number of fields of human activity. From the aforementioned transport of people and cargo to various services (hairdressing, massage, beauty services, accommodation and more).

3. Changing prerequisites for trade union membership

When looking for an answer to the question of how trade unions can contribute to the protection of employees' working conditions in relation to the introduction of technological changes in jobs, we must also look at who is represented by today's trade unions. There has been a gradual outflow of members from trade unions in the former Western Bloc countries since the 1970s. Trade union membership was mandatory in the former Socialist Bloc countries before the change of the political system and a sharp decline occurred only after 1990. Since then, we have witnessed a similar downward trend in the Czech Republic and other post-socialist countries as in the rest of Europe.

This chapter therefore shows how the individual characteristics of employees who are members of trade unions develop. It is based on the ISSP (International Social Survey Programme) survey, specifically the question 'Are you currently a member of a trade union?' with the Yes/No options (with 'I was, but not anymore' option added in some countries).

3.1 Reasons for trade union membership: Three approaches

The likelihood of a particular person becoming a union member can be explained by three different approaches (Riley 1997). The first one is based on the social structuralism approach, which means that a person becomes a member of a trade union based on their social setting. This approach therefore assumes that trade union membership is influenced at the macro level, in particular by the cultural, social, economic and political settings of a particular country (see A. Posthuma 2009 for more details). The likelihood that a new employee will also join a trade union is much higher in a society where union membership is the usual practice of all employees than in countries where union membership is rather exceptional. The likelihood is further influenced by the success of trade unions in collective bargaining, income inequality, achievements of the welfare state and other indicators at the macro level.

The second approach works exclusively with the individual characteristics of employees. So it is at the micro level. The likelihood of a person joining a trade union is determined by their age, education, gender, marital status, employment and other individual characteristics. According to the above-mentioned characteristics or their reflections on the labour market, a person decides whether or not to become a trade union member. It can also be expected that collective protection by trade unions will be sought by groups that have been disadvantaged in the labour market for a long time – women, fresh graduates and seniors before the end of their careers, low-skilled people.

The third approach is based on the mezzo level. It says that it depends on the characteristics of each individual, but these alone are not enough to decide on membership or non-membership in a trade union. An individual must receive the appropriate impulse for this step, e.g. in the form of an economic crisis, high inflation or massive redundancies, and have the opportunity, e.g. in the form of the existence of a trade union in their workplace. If these conditions are not met, the likelihood of someone becoming a member of a trade union decreases significantly.

In fact, all three levels of influence are likely to act simultaneously and differ only in how strong or weak each level is. For example, trade union membership in Nordic countries such as Norway is a common career standard (currently, the trade union membership rate is around 70%). Regardless of their personal characteristics, Norwegian employees are more likely to become members of trade unions than, for example, Czech employees, as the level of trade union involvement in the Czech Republic is somewhere at the level of 10%. However, personal characteristics and various impulses and opportunities are applied even within these structural 'macro' settings.

The decline in trade union membership is generally explained with a number of reasons by the authors (e.g. Blanchflower 2007). One of them is the growing education of society (people with higher education do not need to rely so much on collective protection of trade unions) and greater participation of women in the labour market: women are more likely to work part-time and are not as strongly tied to the labour market as men, therefore they do not seek (contrary to the fact that they are usually disadvantaged in the labour market) membership in collective organizations. Another one is the overall transformation of the labour market structure from classic trade union jobs in the blue-collar sector towards white-collar and service workers. The already described reduction in the size of companies also has an impact; according to the authors, smaller organizations are less likely to form a trade union. Blanchflower includes labour market internationalization, increasing migration and, in general, job flexibilization among other negative effects; trade unions are not able to offer such protection to employees affected by these global phenomena as to traditional employees.

3.2 Research questions, data set used, analytical methods

Since the effects at the macroscopic level are difficult to affect from the point of view of an individual or a trade union, we will focus on the effects at the micro level in further analyses. We will try to find out which personal characteristics of employees best predict their willingness to become members of a trade union. Selecting socio-demographic groups of employees who are not interested in trade union membership can help with targeting further efforts of trade unions both in marketing communication and in the effort to better represent these people in their jobs.

The research question of this chapter is: What personal characteristics of employees predict the likelihood of their membership in a trade union?

To answer this question, we used data from the international ISSP survey for the Czech Republic. We selected those respondents who are in the 25–64 age group, which is the usual range expressing respondents active in the labour market[11].

[11] On the one hand, it excludes people who study and are active in the labour market in the form of various internships, part-time jobs and summer jobs. On the other hand, it also

If we follow this dataset from 2000 to 2019, which are the latest available data, we can observe a decrease in trade union membership from the original about 20%[12] to the current approximately 11.5%. We selected the latest year 2019 for the analysis and it contains 1,265 respondents, of which 45% are men and 55% women. About 32% of the respondents had a lower than secondary education with secondary school leaving certificate (SSLC), 45% had a SSLC and 23% had a university diploma.

As part of the analysis, we will first describe the socio-demographic structure of respondents who are members of trade unions and who are not members of trade unions. This will give us a basic insight into the individual characteristics that affect trade union membership. However, it may be a hidden or indirect influence in some cases. For example, if we assume that men in older age groups are significantly more often university graduates than women[13] in these groups, the apparent impact of age may actually conceal the real impact of education. In order to exclude this mutual impact of individual characteristics, we used binary logistic regression in the second step. It is a method that determines the impact of individual characteristics on the probability of trade union membership if we subtract the impact of all other characteristics of the respondents.

3.3 Description of members of Czech trade unions

This subchapter is focused on the characteristics of members and non-members of trade unions. These are simple percentages without testing the effects of other variables.

Impact of gender: 13.9% of all men active in the labour market, but only 9.8% of all women active in the labour market were members of trade unions in the Czech Republic in 2019. The results are shown in Table 3.1. This finding supports the above assumption that women are not as closely tied to the labour market as men and therefore are less motivated to become members of trade unions. On the other hand, women are – not only in the Czech Republic – more often disadvantaged than men on the labour market, mainly because of their caring role. It would therefore be logical if they sought collective protection by trade unions more often than men.

Table 3.1: Trade union membership by gender

	Male	Female
In unions	13,9 %	9,8 %
Not in unions	86,1 %	90,2 %
Total	100,0 %	100,0 %

Source: ISSP

includes the vast majority of employees of retirement age who continue to earn extra money in addition to their pension for some time.

[12] 18.4% in 2000, 20.5% in 2001, 17.8% in 2002

[13] This was the case in the Czech Republic for university graduates until approximately 2000.

Impact of education: The analysis of trade union membership according to the level of education attained denies the generally ingrained idea that trade unions are mainly a labour organization. Detailed results are shown in Table 3.2. About 11% of all people active in the labour market with primary education or education completed with an apprenticeship certificate were trade union members in 2019. In contrast, only 10% of all SSLC holders were trade union members. Of all employees with a university degree, 15% were trade union members. We explain this inconsistency with the general assumption by the fact that there are strong trade unions involving highly educated employees (health, education, authorities) especially in the public sector.

Table 3.2: Trade union membership by education

	Primary and apprenticeship	SSLC	University
In unions	11,2 %	10,2 %	15,3 %
Not in unions	88,8 %	89,8 %	84,7 %
Total	100,0 %	100,0 %	100,0 %

Source: ISSP

Impact of the type of work: A different view of employees' skills is provided by collar colour. Traditionally, blue collars denote employees who perform manual work in production and white collars include employees performing office jobs[14]. The results of the analysis are shown in Table 3.3. 14% of all blue collars and 11% of all white collars were trade union members in 2019. This finding therefore confirms the assumption that trade unions are more likely to represent manual workers.

Table 3.3: Trade union membership by type of work

	Blue collars	White collars
In unions	14,1 %	11,3 %
Not in unions	85,9 %	88,7 %
Total	100,0 %	100,0 %

Source: ISSP

A more detailed breakdown in terms of occupations is shown in Table 3.4. To create it, we used the ISCO (International Standard Classification of Occupation) reduced to one numerical place. The classification modified in this way divides the occupations into ten large groups, with the 'Members of the Armed Forces' group being usually not available in the data sets from questionnaire surveys.

[14] The division of occupations into ISCO groups is used for the operationalization of blue and white collars. Thus, blue collars include Groups 6–9 (Skilled Agricultural, Forestry and Fishery Workers; Craft and Related Trades Workers; Plant and Machine Operators, and Assemblers, Elementary Occupations), white collars include Groups 1–5 (Managers; Professionals; Technicians and Associate Professionals; Clerical Support Workers; Service and Sales Workers).

Table 3.4 shows that trade union membership is most often chosen by employees in ISCO Group 8, i.e. Plant and Machine Operators and Assemblers. These employees become trade union members in 23.5% of cases. The second most frequently registered group is ISCO Group 9, i.e. Elementary occupations, who choose trade union membership in 15.6% of cases. It is very closely followed by ISCO Group 2 – Professionals, whose members register in trade unions in 14.7% of cases.

According to the share of its representatives in trade unions, ISCO Group 1 – Managers ranked fourth. The fifth, sixth and seventh places were occupied only with a minimum difference of ISCO Group 4 – Clerical Support Workers, 7 – Craft Related Trades Workers and 5 – Service and Sales Workers. The group that becomes members of trade unions the least often is ISCO Group 3 – Technicians and Associate Professionals.

Table 3.4: Trade union membership by type of occupation

ISCO Group	Not union members	Union members	Total
1 – Managers	88,1 %	11,9 %	100,0 %
2 – Professionals	85,3 %	14,7 %	100,0 %
3 – Technicians and Associate Professionals	90,3 %	9,7 %	100,0 %
4 – Clerical Support Workers	89,4 %	10,6 %	100,0 %
5 – Service and Sales Workers	90,0 %	10,0 %	100,0 %
6 – Skilled Agricultural, Forestry and Fishery Workers	100,0 %	0,0 %	100,0 %
7 – Craft and Related Trades Workers	89,7 %	10,3 %	100,0 %
8 – Plant and Machine Operators and Assemblers	76,5 %	23,5 %	100,0 %
9 – Elementary Occupations	84,4 %	15,6 %	100,0 %

Source: ISSP

Impact of age: When comparing by age, we found that the average age of trade union members is 48 years and the average age of non-members is 45 years. There is thus a certain difference that suggests that trade unions are able to reach older employees, but this difference is relatively small.

Impact of voting behaviour: If we look at the structure of members and non-members of trade unions according to what type of political party they voted for in the last elections, we can see clear differences. 72% of respondents who are not trade union members vote for the centre party and there is a slight tendency towards right-wing parties (16% for the right-wing party, 3% for the far-right party, but only 9% for the left-wing party and 1% for the far-left party). The representation of voters of the centre parties is slightly lower (66%) among respondents who belong to a trade union and we can also observe a greater spread of voting behaviour without being able to describe it as even a slight leaning towards left-wing parties (12% for the left, 1% for the far left, 20% for the right, less than 1% for the far right). A detailed view is given in Table 3.5.

Table 3.5: Trade union membership by type of voting behaviour

	In unions	Not in unions
Far left	1,4 %	1,2 %
Left	11,7 %	8,8 %
Centre	66,2 %	71,7 %
Right	20,0 %	15,5 %
Far right	0,7 %	2,8 %
Total	100,0 %	100,0 %

Source: ISSP

Impact of social status: Respondents were further to rank themselves in one of ten social classes, from the lowest class marked with the number 1 to the highest class marked with the number 10[15]. It is surprising that trade union members are on average ranked in a higher social class (average value 6.31) than respondents who are not members (average value 5.9). Class 7 (28.3%) has the highest representation of trade union members, followed by Classes 6 (20.7%) and 5 (15.9%). Among the respondents who are not union members, Class 5 (25.0%) is the most strongly represented, followed by Class 7 (23.5%) and Class 6 (19.6%). The exact distribution of social classes is shown in Table 3.6. Therefore, we cannot say that trade unions would have significantly more representatives of lower social classes in their ranks.

Table 3.6: Trade union membership by social class self-classification

	In unions	Not in unions
1 – lowest	1,4 %	0,7 %
2	0,7 %	1,5 %
3	3,5 %	5,2 %
4	7,6 %	9,2 %
5	15,9 %	25,0 %
6	20,7 %	19,6 %
7	28,3 %	23,5 %
8	13,8 %	11,3 %
9	6,9 %	3,3 %
10 – highest	1,4 %	0,6 %
Total	100,0 %	100,0 %

Source: ISSP

Impact of economic sector: Finally, we looked at the difference in trade union involvement in terms of whether the employee is part of the public or private sector. Employees who work for the government, a government-established organization, a public institution or a non-profit organization were included in the public sector. We included respondents who stated that they work for a privately owned company or are self-employed in the private sector. As

[15] Specifically, it is the question 'There are groups in our society to which high social status is attributed and, on the contrary, groups with low social status. Where would you personally rank yourself on the following scale?'

Table 3.7 shows, there is a significant difference between the two sectors. Of all employees working in the public sector, 21.4% are members of trade unions. In contrast, only 8.9% of all employees working in the private sector are members of trade unions. Again, we point to the high numbers of employees in the public sector who are ‘covered’ by strong trade unions – education, healthcare, state administration.

Table 3.7: Trade union membership by sector

	Public sector	Private sector
In unions	21,4 %	8,9 %
Not in unions	78,6 %	91,1 %
Total	100,0 %	100,0 %

Source: ISSP

3.4 Chances of trade union membership

As already mentioned, the descriptive statistics presented in the previous subchapter always show the impact of only one variable. For example, they describe the structure of trade union membership in terms of gender. In the next step, they describe the structure of trade union membership by education, for example. They do not take into account that gender and education are interdependent, i.e. that education is unequally distributed between men and women. By showing the impact of gender, it actually shows the impact of education in part, and by showing the impact of education, it also shows the impact of gender in part. Of course, the whole model includes, for example, age (education is unevenly distributed between the genders within different age groups) and other variables.

For this reason, we also carried out a comprehensive analysis which, using the binary logistic regression, shows what is the net impact of all the variables involved, after deducting the impact of others. The output is the net impact of gender (after deducting the impact of education, age and others), then the net impact of education (after deducting the impact of age, gender and others) and so on.

Without going into deep mathematical details, we can reveal that the outputs of binary logistic regression are logarithmic coefficients which can be interpreted as the odds ratio after a small mathematical adjustment (exposure). The numbers presented below therefore show how much higher or lower the chance of trade union membership is for an employee with a certain characteristic compared to an employee who does not have this characteristic. We will try to describe everything as clearly as possible.

First, we looked at the impact of gender. It turned out that after deducting the impact of all other variables, women have a 25.8% lower chance of trade union membership than men. Older employees also have a higher chance of being members of a trade union. With each year of age, the chance of trade union membership increases by about 1.7% (i.e. a 10-year-older employee's chance of trade union membership is 11.7% higher).

Looking at the net impact of education, we can state that employees with a SSLC have a 7% lower chance of being in trade unions than employees with an apprenticeship certificate or primary education. We also compare university students with this reference category (primary school + apprenticeship). They have a significantly higher chance, namely by 29.7%.

Employees performing manual work (blue collars) have a 57.9% higher chance of trade union membership compared to office workers (white collars). Once again, please note that this is a net impact of the type of work performed in the control for gender, education, age and other variables.

From the point of view of political orientation, each degree on the five-point left-right scale reduces the chance of union membership by 5%. Thus, the far-right voter has a 25% lower

chance of union membership than the far-left voter and vice versa. The social class self-classification predicts their membership in trade unions with a force of 16% for each point on a ten-point scale. Surprisingly, an employee from the highest social class (10) has a 144% higher chance of trade union membership than an employee who ranks themselves in the lowest social class (1). Employees working in the private sector are 62% less likely to be members of trade unions than their public sector counterparts.

If we were to summarize the results of the regression analysis, the lowest chance of trade union membership is a hypothetical employee who is a young woman with a SSLC working in an office in the private sector, electing the far right and classifying herself as the lowest social class. This roughly corresponds to a bank clerk (with a far-right orientation), for example. On the contrary, a university-educated man of high age who performs manual work (sic!), ranks himself in the highest social class, elects the far left and works in the public sector has the highest chance of trade union membership. Apart from the blue collars, it may be a teacher, doctor or manager in the public sphere (with a left-wing orientation).

3.5 Summary of the prerequisites for trade union membership

We have gradually shown some important facts in this chapter.

Firstly, trade union membership is declining, in fact in all European Union countries. The reasons are higher education of the population, the transition from traditional unionized occupations in industry to less unionized occupations in the service sector, the inability of trade unions to represent the needs of flexible or precarious employees.

Secondly, we described the structure of the current labour market in the Czech Republic and showed what characteristics two large groups have – a group of those who are members of a trade union and a group of those who are not members of a trade union. Thirdly, since these characteristics influence each other to a large extent, we have shown what is the impact of individual characteristics after netting out the impact of all other characteristics.

Thus, we answered the question of which employees are currently represented by trade unions in the Czech Republic and which employees are not represented by them. This can help in reaching out to potential new members or in better targeting the services and benefits provided to existing ones.

4. Digitalization of Czech society

The digitalization of human society has been taking place since about the 1970s, when the first commercially available computers were created. The gradual shift from large mainframes to personal computers that fit on the table and the purchase price of which gradually decreased enabled the wide use of computer technology in all spheres of human activity. Further acceleration took place at the end of the 20th century, when computer networks, especially the global Internet, underwent great development.

It was the combination of cheap powerful computers found in almost every home, an affordable and fast enough Internet connection and a user-friendly web environment that was a big driver of digital services.

These got their latest impulse in the form of the expansion of smartphones and wireless networks of all kinds, from data networks of mobile operators to freely accessible Wi-Fi networks. Nowadays, everyone can literally have a powerful and easy-to-use computer (smartphone) in their pocket, which can be connected to the Internet 24 hours a day, 7 days a week.

Experience from other countries shows that there are still certain groups of people who have not succumbed to the pressures of digitalizing everyday life. These groups will be disadvantaged in connection with the introduction of digital technologies into jobs. This chapter will therefore address the extent to which Czech society is digitalized and which parts of society resist digitalization.

First, we will look at the example of Estonia, which is a European leader in the digitalization of society and state administration. It also had to deal with certain groups of inhabitants that needed to be gradually led to digitalization. Then we will focus on the possible positive impact of the COVID-19 pandemic, which had a positive, if not permanent, impact on digitalization. In the next step, we will look at the current state of digitalization of various groups of Czech society using data from 2022.

4.1 Experiences from Estonia

Estonia is usually given as an example to all those who talk about the importance of digitalizing the state administration. Less than 40% of Estonians used computers and the Internet un 2000, when the country was still considering the introduction of digital services. The government carried out several research surveys to find that approximately the same groups that already face a number of disadvantages on the labour market suffer from insufficient digitalization. These are older residents, people with lower education, women and migrants.

In further research, it was found that respondents have three reasons for not using digital technologies. The financial reason was the easiest to solve – some Estonians simply did not have enough funds to buy a computer and pay for regular Internet connection fees. Such a shortage was easily solved by the Estonian government through several subsidy programs for socially disadvantaged residents.

The second reason was the lack of knowledge. Although modern computer technology penetrated the former socialist countries as early as the beginning of 1990s, when today's people in their fifties were just reaching their thirtieth birthday, many of them did not meet with computers during their working lives. They had no opportunities or reasons to get acquainted with computer operation even in a non-working environment and remained digitally illiterate. Correcting the problem is more difficult in this respect; the Estonian government introduced a number of retraining courses and hobby groups and strengthened the teaching of computer technology in schools of all levels and specializations.

The third reason was lack of motivation. Part of the population could not find any reason why they should use the computer, why the Internet could be useful to them. They were thus unwilling to acquire it (not even at a subsidized price) or learn how to use it (not even in free government courses). In this regard, it was necessary to develop services that would be able to convince Estonians of their usefulness and to present these services to hesitant inhabitants in a sufficiently attractive way.

The situation in the use of digital technologies improved significantly after several years of efforts by the Estonian government. Of the original 60% of Estonians who did not use the Internet at the beginning of the century, this share fell by about half, i.e. 30%, by 2007. Estonia reported that less than 10% of the country's population is affected by digital lag in 2017.

4.2 COVID-19 and digitalization

Despite all the undeniable negatives that the long-term COVID-19 pandemic has had on various parts of our lives, it seems that the digitalization of society has had a positive impact. An integral part of the pandemic was a set of restrictions on the movement of people, partial closure of various types of production, shops and services, closure of offices; all motivated by the effort to limit the spread of the virus.

A whole range of human activities thus logically moved into the digital world. Doctors began issuing electronic prescriptions and medical certificates just before the pandemic. They were then able to perform a number of remote examinations during the pandemic, for example based on the photos or webcam footage provided. The authorities strengthened the electronic receipt of applications and other submissions and citizens began to make more use of this option. The registration for the COVID-19 vaccination was carried out exclusively digitally, as was the issuance of a certificate of vaccination or otherwise acquired immunity.

Pupils and students at all levels of the education system completed the classes or part of them online. Concerts and theatre performances moved into the digital world. A number of discussion associations meeting in a café, wine bar or pub began to discuss in the online space. It was necessary to use telecommunication services or the Internet to communicate with acquaintances, friends and family members.

All this led Czech society to several significant changes. Those who did not have a computer at home (or did not have enough of them to satisfy home-working parents and home-

educated children) had to get one, including additional equipment such as microphones, headphones or webcams. Those who did not have an internet connection at home had to have it set up. Those with a low-speed Internet connection that could not handle several parallel video transmissions (already mentioned working parents and studying children at the same time) had to have it strengthened in a proper way. Those who did not have at least basic computer and Internet skills had to acquire them quickly. Finally, to exhaust all the reasons given in the previous chapter on Estonia, those who did not see any sense in using computer technology suddenly found this sense.

Therefore, we can assume that the COVID-19 pandemic or the measures associated with it significantly contributed to the digitalization of Czech society. The following paragraphs present how true this assumption is or to what extent this assumption is reflected in the statistical data.

However, one important question remains unanswered. If we believe the claim that the COVID-19 pandemic strengthened the digitalization of the Czech Republic, to what extent is this strengthening permanent? Did certain groups of residents lose interest in the use of digital technologies when all the restrictions on movement and mutual contact of people were relaxed, when theatres, offices, schools and doctors returned to their usual premises? Or are the benefits so great that they use the Internet and computers even when COVID-19 no longer forces them to do so?

We selected as a data set the Sample Survey on the Use of Information and Communication Technologies in Households and Among Persons (VŠIT), which has been carried out annually by the Czech Statistical Office since 2003. Researchers obtained information on 6,779 people over 16 years of age living in 4,049 households on common budget in 2022. The VŠIT survey is representative of the population of people living in the Czech Republic aged 16 years and over. It was a group of 8.8 million people and 4.5 million households in 2022.

In order to show the impact of the COVID-19 pandemic and its permanency, we compared information for the entire Czech population at three points in time without further sorting. The first year is 2019, which is the last year not affected by the COVID-19 pandemic. The second year of comparison is 2020, when the most regulatory restrictions were in force. If there is a positive difference in individual indicators between 2020 and 2019, it means that there was an increase in IT use in that area during the pandemic. The third year of comparison is 2022, the last one from which we have available data. It is also the first year not affected by the COVID-19 pandemic at all. If there is a negative difference between 2020 and 2022, it means that there was a decrease in IT use in that area after the COVID-19 pandemic.

To cover every aspect, we add that a more detailed view of individual indicators in the classification according to various socio-demographic characteristics will be part of the following subchapter, but only for 2022.

As Table 4.1 shows, not all areas of use of computer technology and the Internet experienced a significant increase during the COVID-19 pandemic. In fact, we can only talk about intensity in the case of purchasing goods and services via the Internet, where there was a change by 12%. There was a slight increase between 2019 and 2020 only in the field of education (by

about 2%). There was a stagnation (stagnation means a change that is less than 1%, either in a positive or negative direction) or even a slight decline in other cases. The use of email decreased by 1.18%, the use of social networks by 2.45%, reading news on the Internet by 2.2% and sales of goods or services by 1.73%.

This discrepancy with our original assumption can be explained by the date and time of collection. The Czech Statistical Office states that it collects data in the second quarter of the calendar year (together with the Labour Force Survey, which will be discussed in the next chapter). However, the collection is probably done gradually, not at one time in all households. It is therefore likely that some households received the questionnaire at the beginning of April, when the set of government restrictions was only gaining strength, some at a time when the measures were already in force, but there was confusion about what could be moved to the Internet, some at the peak of online life and some in the short interims when various measures were gradually relaxed or tightened. Naturally, the respondents answered according to their current situation, as asked by the questions (most of them asked about the occurrence of the activity in the last three months). Thus, we can assume that the period of the COVID-19 pandemic was too turbulent to be captured by a relatively slow sample survey.

Table 4.1: Use of selected Internet services in the last 3 months in the Czech Republic in 2019–2022

	2019	2020	2020–2019	2022	2022–2020
Internet use at least once a week	70,73 %	70,02 %	-0,71 %	74,39 %	4,37 %
Email	68,38 %	67,20 %	-1,18 %	70,35 %	3,15 %
Social networks	45,77 %	43,32 %	-2,45 %	47,10 %	3,78 %
YouTube	42,90 %	42,90 %	0,00 %	48,97 %	6,07 %
Reading news	67,18 %	64,98 %	-2,20 %	69,95 %	4,97 %
Education	4,31 %	6,40 %	2,09 %	11,58 %	5,18 %
Sale of goods/services	9,37 %	7,64 %	-1,73 %	10,67 %	3,03 %
Purchase of goods/services	32,32 %	44,32 %	12,00 %	50,27 %	5,95 %
Banking	54,79 %	54,48 %	-0,31 %	61,44 %	6,96 %

Source: VŠIT

Now let's look at the change until 2022. 2022 was already stable enough – at least in terms of the COVID-19 pandemic. Conducting a sample survey in the second quarter of the calendar year could thus capture a steady state, not chaotic changes caused by a rapid change in the situation.

Indeed, a stable increase of between 3 and 7% can be observed in all indicators. Apparently, gradual digitalization of Czech society occurred both between 2020 and 2022 and between 2019 and 2022. 74% of Czechs use the Internet at least once a week after the COVID-19 pandemic. The vast majority of them can use email; only 47% regularly appear on social networks. Watching Internet videos on YouTube-type servers (49%) and reading daily news in electronic form (70%) is slowly growing. Online learning experienced a significant increase to more than double the 2019 figures. The forced digitalization of the entire Czech education system probably showed the wider population that it is possible to learn through the Internet

in some way. Online trading in goods and services continues to strengthen and the use of online banking is also growing.

If we were to decide now on the validity of the two statements presented in this subchapter, we would have to say something like this: The COVID-19 pandemic probably contributed to the faster digitalization of Czech society, but cross-sectional data collection in the second quarter of the calendar year could not adequately capture this. The digitalization of Czech society continues even after the COVID-19 pandemic. Internet use is growing in all indicators. The last part of this chapter is aimed at which parts of the Czech population use individual Internet services and which do not.

4.3 Digitalization of various parts of Czech society

We looked at the current state (we use the latest available data for 2022) of the use of digital technologies by various population groups in the final part of the chapter on the digitalization of Czech society. We will focus on the same indicators that we discussed in the previous subchapter devoted to the development during the COVID-19 pandemic.

Table 4.2: Groups using the Internet at least once a week

	Yes	No	Total
Total	74,4 %	25,6 %	100,0 %
Gender			
Male	78,9 %	21,1 %	100,0 %
Female	70,7 %	29,3 %	100,0 %
Education			
Primary	53,0 %	47,0 %	100,0 %
Apprenticeship	64,8 %	35,2 %	100,0 %
SSLC	81,9 %	18,1 %	100,0 %
University	93,2 %	6,8 %	100,0 %
Age group			
16–24 years	99,4 %	0,6 %	100,0 %
25–34 years	99,3 %	0,7 %	100,0 %
35–44 years	98,6 %	1,4 %	100,0 %
45–54 years	95,6 %	4,4 %	100,0 %
55–64 years	84,7 %	15,3 %	100,0 %
65 or older	42,9 %	57,1 %	100,0 %
ISCO Group			
1 – Managers	99,4 %	0,6 %	100,0 %
2 – Professionals	98,7 %	1,3 %	100,0 %
3 – Technicians and Associate Professionals	99,1 %	0,9 %	100,0 %
4 – Clerical Support Workers	98,4 %	1,6 %	100,0 %
5 – Service and Sales Workers	95,2 %	4,8 %	100,0 %

6 – Skilled Agricultural, Forestry and Fishery Workers	85,0 %	15,0 %	100,0 %
7 – Craft and Related Trades Workers	93,2 %	6,8 %	100,0 %
8 – Plant and Machine Operators and Assemblers	93,6 %	6,4 %	100,0 %
9 – Elementary Occupations	89,1 %	10,9 %	100,0 %

Source: VŠIT

First, we investigated how individual groups of residents use the Internet. From the options offered by the relevant question in the questionnaire, we selected the categories (I use the Internet at work or at home) 'several times a day', 'every day or almost every day' and 'at least once a week'. We merged these categories into one 'at least once a week' category and we present the share of people in this category in Table 4.2.

As the table shows, men use the Internet on a regular basis slightly more often than women. We found a much stronger dependence between Internet use and education – the higher the education, the higher the proportion of people using the Internet at least once a week. The difference between persons with an apprenticeship certificate and persons with a university diploma is about 30 percentage points (pp). Internet use also gradually decreases with increasing age. While almost everyone uses the Internet in the youngest age groups, it is only 85% especially after 55 years of age and even less than half, namely 43% of respondents, after retirement. There are not any significant differences in the use of the Internet by different types of employees, with the exception of employees in ISCO Group 6 – Skilled Agricultural, Forestry and Fishery Workers. After all, as we will see in other analyses, Group 6 shows significantly lower use of digital technologies in almost all categories.

In the next step, we investigated who among the respondents used various Internet services or used the Internet for certain purposes in the last three months. First of all, we looked at the use of email communication. As the results summarized in Table 4.3 show, about 70% of respondents use this service, regardless of other characteristics. As in the previous case, we found gender differences here; men use emails about 7 pp more than women. Equally unsurprising is the connection with the highest level of education achieved. While primary school graduates use email only in 47% of cases and those with apprenticeship certificates only by 11 pp more, university graduates basically cannot do without email. Its regular use was declared by 92% of them. In terms of age distribution, it is obviously true that email is mainly used by people of study and working age. The use of email begins to decline gradually at first around the age of 50 years, significantly faster after the age of 55. If we look at the use of emails according to the main occupation groups, it is most used by managers, professionals and technicians. Apart from the usual exception in the form of farmers, the members of ISCO Group 8 – Plant and Machine Operators and Assemblers and ISCO Group 9 – Elementary Occupations use email communication less.

Table 4.3: Groups using email in the last three months

	Yes	No	Total
Total	70,4 %	29,6 %	100,0 %
Gender			
Male	74,3 %	25,7 %	100,0 %
Female	67,1 %	32,9 %	100,0 %
Education			
Primary	46,9 %	53,1 %	100,0 %
Apprenticeship	58,2 %	41,8 %	100,0 %
SSLC	79,9 %	20,1 %	100,0 %
University	91,5 %	8,5 %	100,0 %
Age group			
16–24 years	97,0 %	3,0 %	100,0 %
25–34 years	97,5 %	2,5 %	100,0 %
35–44 years	96,2 %	3,8 %	100,0 %
45–54 years	92,3 %	7,7 %	100,0 %
55–64 years	78,5 %	21,5 %	100,0 %
65 or older	37,9 %	62,1 %	100,0 %
ISCO Group			
1 – Managers	100,0 %	0,0 %	100,0 %
2 – Professionals	99,8 %	0,2 %	100,0 %
3 – Technicians and Associate Professionals	98,7 %	1,3 %	100,0 %
4 – Clerical Support Workers	97,7 %	2,3 %	100,0 %
5 – Service and Sales Workers	91,6 %	8,4 %	100,0 %
6 – Skilled Agricultural, Forestry and Fishery Workers	80,0 %	20,0 %	100,0 %
7 – Craft and Related Trades Workers	90,7 %	9,3 %	100,0 %
8 – Plant and Machine Operators and Assemblers	85,6 %	14,4 %	100,0 %
9 – Elementary Occupations	82,2 %	17,8 %	100,0 %

Source: VŠIT

Another question focused on the use of social networks, without the authors of the sample survey distinguishing between their different types. Each respondent could thus interpret the term ‘social network’ as anything from TikTok, intended especially for young people, to the professional social network LinkedIn, used by employees and HR managers. Despite this free definition, only 47.1% of respondents declared using a social network in the last three months. The difference between men and women is still noticeable in this case, but it is only 2.4 pp. In terms of education, social networks are the least used by persons with apprenticeship certificates. The use of social networks increases up to 60% with increasing level of education (SSLC, university). Primary school graduates join apprentices and secondary school graduates in this respect, which can be interpreted as the impact of age – a significant part of

respondents declaring primary education as the highest completed are in fact students at secondary schools. Another part of Table 4.4 indirectly supports this assumption. The use of social networks is the strongest in the two youngest age groups (16-34 years) and then decreases very quickly. While the two youngest groups use social networks in 94 to 97% of cases, seniors over the age of 65 engage in this activity only in 12% of cases. Compared to previous cases, the use of social networks is not the highest among managers. Social networks are mostly used by workers belonging to ISCO Group 3 – Technicians and Associate Professionals. The use of social networks is lower in groups where manual workers are included.

Table 4.4: Groups using social networks in the last three months

	Yes	No	Total
Total	47,1 %	52,9 %	100,0 %
Gender			
Male	48,4 %	51,6 %	100,0 %
Female	46,0 %	54,0 %	100,0 %
Education			
Primary	40,9 %	59,1 %	100,0 %
Apprenticeship	36,2 %	63,8 %	100,0 %
SSLC	53,6 %	46,4 %	100,0 %
University	60,0 %	40,0 %	100,0 %
Age group			
16–24 years	96,8 %	3,2 %	100,0 %
25–34 years	93,8 %	6,2 %	100,0 %
35–44 years	82,8 %	17,2 %	100,0 %
45–54 years	64,0 %	36,0 %	100,0 %
55–64 years	37,7 %	62,3 %	100,0 %
65 or older	11,6 %	88,4 %	100,0 %
ISCO Group			
1 – Managers	68,6 %	31,4 %	100,0 %
2 – Professionals	70,9 %	29,1 %	100,0 %
3 – Technicians and Associate Professionals	77,6 %	22,4 %	100,0 %
4 – Clerical Support Workers	70,4 %	29,6 %	100,0 %
5 – Service and Sales Workers	67,7 %	32,3 %	100,0 %
6 – Skilled Agricultural, Forestry and Fishery Workers	55,0 %	45,0 %	100,0 %
7 – Craft and Related Trades Workers	66,1 %	33,9 %	100,0 %
8 – Plant and Machine Operators and Assemblers	62,6 %	37,4 %	100,0 %
9 – Elementary Occupations	64,9 %	35,1 %	100,0 %

Source: VŠIT

The sample survey also included a question about watching videos on the Internet using services such as YouTube. As the results summarized in Table 4.5 show, regardless of other characteristics, 49% of respondents report that they watched videos on the Internet in the last three months. Men differ more strongly from women in this case, at a ratio of about 54% : 45%. Again, we observed a connection with the highest level of education achieved. While people with apprenticeship certificates watched videos only in 38% of cases, university students devoted themselves to this activity on the Internet in approximately 66% of cases. The connection with age, which is inversely proportional, is also significantly stronger than in previous cases. The older the age of the respondent, the less likely they are to use the Internet to watch videos. While 93% of people report this activity in the youngest age category of 16–24 years, the same indicator reaches only 65% from 45 to 54 years of age, it drops sharply to 46% in the pre-retirement age and even to only 15% after 65 years of age. From the point of view of the basic ISCO groups, videos are most often watched by white collars who are not managers, i.e. ISCO Groups 2, 3 and 4 (Professionals; Technicians and Associate Professionals; Clerical Support Workers). Employees belonging to ISCO Group 9 – Elementary Occupations report watching Internet videos the least.

Table 4.5: Groups using YouTube in the last three months

	Yes	No	Total
Total	49,0 %	51,0 %	100,0 %
Gender			
Male	53,6 %	46,4 %	100,0 %
Female	45,2 %	54,8 %	100,0 %
Education			
Primary	38,9 %	61,1 %	100,0 %
Apprenticeship	38,3 %	61,7 %	100,0 %
SSLC	54,7 %	45,3 %	100,0 %
University	65,7 %	34,3 %	100,0 %
Age group			
16–24 years	93,4 %	6,6 %	100,0 %
25–34 years	87,5 %	12,5 %	100,0 %
35–44 years	81,5 %	18,5 %	100,0 %
45–54 years	65,4 %	34,6 %	100,0 %
55–64 years	45,6 %	54,4 %	100,0 %
65 or older	15,3 %	84,7 %	100,0 %
ISCO Group			
1 – Managers	69,8 %	30,2 %	100,0 %
2 – Professionals	76,1 %	23,9 %	100,0 %
3 – Technicians and Associate Professionals	78,2 %	21,8 %	100,0 %
4 – Clerical Support Workers	74,0 %	26,0 %	100,0 %
5 – Service and Sales Workers	67,9 %	32,1 %	100,0 %
6 – Skilled Agricultural, Forestry and Fishery Workers	60,0 %	40,0 %	100,0 %

7 – Craft and Related Trades Workers	64,5 %	35,5 %	100,0 %
8 – Plant and Machine Operators and Assemblers	63,7 %	36,3 %	100,0 %
9 – Elementary Occupations	58,1 %	41,9 %	100,0 %

Source: VŠIT

While social media or YouTube videos are probably for entertainment purposes in most cases, reading newspapers and magazines has undeniable educational value. As the results summarized in Table 4.6 show, about 70% of respondents are engaged in this activity on the Internet. Men use the Internet to read reports 9 pp more often than women. The connection between the level of education achieved and reading the news is alarming – the proportion of respondents is gradually growing from 45% (for people with primary education) to 91% for people with a university diploma.

Table 4.6: Groups reading news in the last three months

	Yes	No	Total
Total	70,0 %	30,0 %	100,0 %
Gender			
Male	74,9 %	25,1 %	100,0 %
Female	65,9 %	34,1 %	100,0 %
Education			
Primary	44,7 %	55,3 %	100,0 %
Apprenticeship	60,2 %	39,8 %	100,0 %
SSLC	77,9 %	22,1 %	100,0 %
University	90,8 %	9,2 %	100,0 %
Age group			
16–24 years	83,9 %	16,1 %	100,0 %
25–34 years	93,8 %	6,2 %	100,0 %
35–44 years	91,4 %	8,6 %	100,0 %
45–54 years	90,2 %	9,8 %	100,0 %
55–64 years	80,1 %	19,9 %	100,0 %
65 or older	42,0 %	58,0 %	100,0 %
ISCO Group			
1 – Managers	96,2 %	3,8 %	100,0 %
2 – Professionals	96,1 %	3,9 %	100,0 %
3 – Technicians and Associate Professionals	95,6 %	4,4 %	100,0 %
4 – Clerical Support Workers	94,7 %	5,3 %	100,0 %
5 – Service and Sales Workers	88,6 %	11,4 %	100,0 %
6 – Skilled Agricultural, Forestry and Fishery Workers	75,0 %	25,0 %	100,0 %
7 – Craft and Related Trades Workers	86,1 %	13,9 %	100,0 %
8 – Plant and Machine Operators and Assemblers	85,8 %	14,2 %	100,0 %
9 – Elementary Occupations	76,4 %	23,6 %	100,0 %

Source: VŠIT

With the exception of the youngest generation (16–24 years), people under 54 read news on the Internet at about the same rate, around 90%. The decrease is noticeable both in the already mentioned youngest age category (84%) and in the oldest respondents (over 55 years: 80%, over 65 years: 42%). Looking at the reading of news within the main ISCO groups, this phenomenon is common to a similar extent in white collars (Managers; Professionals; Technicians and Associate Professionals; Clerical Support Workers: 95–96%), about 10 pp lower in blue collars and the lowest in farmers and elementary occupations.

We estimate that the findings presented in Table 4.6 are approximately consistent with those that would apply to print media or news in general. In this case, the Internet is just another channel used by similar groups.

If we describe the use of social networks as an utterly fun activity and watching Internet videos as an activity that can be half fun, half educational, then the following question is strictly aimed at education. It asks respondents whether they have completed an educational course via the Internet in the last three months at school or work. The answers of the respondents of different groups are clearly summarized in Table 4.7. This experience is reported by approximately 12% of respondents over 16 years of age. The proportion between men and women is rarely balanced in this case. Significant differences are shown depending on education. If we exclude the special category of respondents with primary education (from which part is currently studying secondary schools and thus to a greater extent completes educational courses as part of their studies), people with apprenticeship certificates expand their skills via the Internet only in 2% of cases. In contrast, people with a SSLC report this activity in 14% of cases and people with a university degree even in 29% of cases. This confirms the findings of a number of previous researches that people with higher education gain a qualification advantage already at the time of their studies, which they then increase throughout their lives by participating in other courses and training to a significantly greater extent. The highest rate of using online courses is while studying (age of 16–24 years), when it reaches about 35%. It is around 20% during the active working life, decreasing to 9% at the end of the career as retirement approaches (55–64 age group) and 1% in retirement. Of the employee groups defined by ISCO, professionals are the most educated (ISCO Group 2). The remaining white-collar members (ISCO Groups 1 – Managers, 3 – Technical and Associate Professionals and 4 – Clerical Support Workers) use this service in about 26% of cases. In contrast, blue collars almost do not use further education via the Internet, they report this service in 1–5% of cases. A kind of connecting link are employees in trade and services who used an online course in the last three months in about one tenth of cases.

The Internet is also a suitable platform for trading; therefore the questionnaire contains a number of questions regarding the sale and purchase of goods or services. Of these, we selected two that, in our opinion, best describe the issue. First of all, we looked at whether the respondents actively sold something over the Internet in the last three months, whether it was goods or a service and whether they used specialized websites or applications or agreed to sell it through social networks, for example. The answers to this question are summarized in Table 4.8. About 11% of respondents reported experience with active sales. Men sell about 1 pp more than women over the Internet. Considering the highest education attained,

university students sell the most via the Internet (in about 16% of cases), while those with the lowest education sell the least (about half as many as university students). In terms of age, this function of the Internet is most often reported by the group of young adults (25–34 years: 30%); the use of the Internet to sell goods and services is decreasing with increasing age. The turning point is again around the age of 50 years. It is worth noting the relatively low use of the Internet for sale in the youngest age category of 16–24 years (only 18%). We believe that these are largely students who do not yet offer any services and have not managed to accumulate the amount of property that they would need to get rid of via the Internet. The situation is relatively balanced from the perspective of ISCO groups. Only the manual occupations show a significant difference, ISCO Group 8 – Plant and Machine Operators and Assemblers and 9 – Elementary Occupations. They are joined, somewhat surprisingly, by ISCO Group 1 – Managers. It is likely that the first two mentioned groups do not have sufficient skills to use this service, while the management class does not need such sales or does not have time for it.

Table 4.7: Groups using training in the last three months

	Yes	No	Total
Total	11,6 %	88,4 %	100,0 %
Gender			
Male	11,5 %	88,5 %	100,0 %
Female	11,7 %	88,3 %	100,0 %
Education			
Primary	9,3 %	90,7 %	100,0 %
Apprenticeship	1,6 %	98,4 %	100,0 %
SSLC	13,6 %	86,4 %	100,0 %
University	29,2 %	70,8 %	100,0 %
Age group			
16–24 years	34,6 %	65,4 %	100,0 %
25–34 years	20,1 %	79,9 %	100,0 %
35–44 years	20,3 %	79,7 %	100,0 %
45–54 years	16,7 %	83,3 %	100,0 %
55–64 years	8,9 %	91,1 %	100,0 %
65 or older	1,4 %	98,6 %	100,0 %
ISCO Group			
1 – Managers	26,4 %	73,6 %	100,0 %
2 – Professionals	41,0 %	59,0 %	100,0 %
3 – Technicians and Associate Professionals	26,8 %	73,2 %	100,0 %
4 – Clerical Support Workers	26,3 %	73,7 %	100,0 %
5 – Service and Sales Workers	10,2 %	89,8 %	100,0 %
6 – Skilled Agricultural, Forestry and Fishery Workers	5,0 %	95,0 %	100,0 %
7 – Craft and Related Trades Workers	3,0 %	97,0 %	100,0 %
8 – Plant and Machine Operators and Assemblers	3,0 %	97,0 %	100,0 %

9 – Elementary Occupations	1,1 %	98,9 %	100,0 %

Source: VŠIT

A much more common way of e-commerce is undoubtedly the purchase of goods or services by the respondent. This is also shown by the results of the answers to this question summarized in Table 4.9. Half of the respondents declare their experience with online shopping in the last three months. The difference between men and women in this case is about 4 pp in favour of men who report online shopping more often than women. As usual, we found a strong dependence on the level of education achieved. While primary school graduates shop online in only 31% of cases (and graduates without a SSLC in 36% of cases), people with a SSLC report this way of using the Internet in 59% of cases and university-educated respondents even in 75% of cases.

Table 4.8: Groups using sales of goods/services in the last three months

	Yes	No	Total
Total	10,7 %	89,3 %	100,0 %
Gender			
Male	11,3 %	88,7 %	100,0 %
Female	10,2 %	89,8 %	100,0 %
Education			
Primary	6,3 %	93,7 %	100,0 %
Apprenticeship	7,5 %	92,5 %	100,0 %
SSLC	12,5 %	87,5 %	100,0 %
University	16,4 %	83,6 %	100,0 %
Age group			
16–24 years	17,8 %	82,2 %	100,0 %
25–34 years	30,4 %	69,6 %	100,0 %
35–44 years	22,2 %	77,8 %	100,0 %
45–54 years	12,4 %	87,6 %	100,0 %
55–64 years	6,8 %	93,2 %	100,0 %
65 or older	1,4 %	98,6 %	100,0 %
ISCO Group			
1 – Managers	12,6 %	87,4 %	100,0 %
2 – Professionals	20,5 %	79,5 %	100,0 %
3 – Technicians and Associate Professionals	14,5 %	85,5 %	100,0 %
4 – Clerical Support Workers	19,4 %	80,6 %	100,0 %
5 – Service and Sales Workers	16,2 %	83,8 %	100,0 %
6 – Skilled Agricultural, Forestry and Fishery Workers	17,5 %	82,5 %	100,0 %
7 – Craft and Related Trades Workers	17,1 %	82,9 %	100,0 %
8 – Plant and Machine Operators and Assemblers	10,5 %	89,5 %	100,0 %
9 – Elementary Occupations	10,3 %	89,7 %	100,0 %

Source: VŠIT

The connection with age is similar as for the question about online sales. The strongest group in this case is the 25–34 age group; generally, people up to 45 years of age stay above the 80% limit. After that, online shopping begins to decline slowly (45–54 age group: 70%), then sharply (55–64 age group: 51%, 65+ age group: 17%). There is a large imbalance in the use of online shopping between different groups of employees. It is mostly used by members of ISCO Group 1 – Managers (93%). We believe this is due to their workload. Buying goods and services over the Internet with their subsequent delivery, for example by courier, simply saves time. Generally, white collars use online shopping relatively often (about 80% of respondents). For blue collars, the use of online shopping decreases with decreasing skills from 71% (ISCO Group 5 – Service and Sales Workers) to 49% (ISCO Group 9 – Elementary Occupations).

Table 4.9: Groups using purchases of goods/services in the last three months

	Yes	No	Total
Total	50,3 %	49,7 %	100,0 %
Gender			
Male	52,7 %	47,3 %	100,0 %
Female	48,3 %	51,7 %	100,0 %
Education			
Primary	31,4 %	68,6 %	100,0 %
Apprenticeship	36,0 %	64,0 %	100,0 %
SSLC	58,9 %	41,1 %	100,0 %
University	74,5 %	25,5 %	100,0 %
Age group			
16–24 years	81,3 %	18,7 %	100,0 %
25–34 years	88,9 %	11,1 %	100,0 %
35–44 years	80,5 %	19,5 %	100,0 %
45–54 years	70,2 %	29,8 %	100,0 %
55–64 years	50,5 %	49,5 %	100,0 %
65 or older	16,7 %	83,3 %	100,0 %
ISCO Group			
1 – Managers	92,5 %	7,5 %	100,0 %
2 – Professionals	86,4 %	13,6 %	100,0 %
3 – Technicians and Associate Professionals	80,6 %	19,4 %	100,0 %
4 – Clerical Support Workers	79,0 %	21,0 %	100,0 %
5 – Service and Sales Workers	71,1 %	28,9 %	100,0 %
6 – Skilled Agricultural, Forestry and Fishery Workers	55,0 %	45,0 %	100,0 %
7 – Craft and Related Trades Workers	64,9 %	35,1 %	100,0 %
8 – Plant and Machine Operators and Assemblers	62,3 %	37,7 %	100,0 %
9 – Elementary Occupations	49,4 %	50,6 %	100,0 %

Source: VŠIT

The last indicator that we decided to introduce in this subchapter is the use of online banking. In our opinion, this represents a number of other phenomena – the willingness to manage personal finances via a computer, trust in the reliability and security of Internet services and readiness to use digital state administration services through a bank ID. The results of the answers to the question regarding the use of online banking in the last three months are clearly summarized in Table 4.10.

Table 4.10: Groups using online banking in the last three months

	Yes	No	Total
Total	61,4 %	38,6 %	100,0 %
Gender			
Male	65,9 %	34,1 %	100,0 %
Female	57,7 %	42,3 %	100,0 %
Education			
Primary	30,1 %	69,9 %	100,0 %
Apprenticeship	50,1 %	49,9 %	100,0 %
SSLC	71,3 %	28,7 %	100,0 %
University	85,9 %	14,1 %	100,0 %
Age group			
16–24 years	72,5 %	27,5 %	100,0 %
25–34 years	94,5 %	5,5 %	100,0 %
35–44 years	92,3 %	7,7 %	100,0 %
45–54 years	85,3 %	14,7 %	100,0 %
55–64 years	68,5 %	31,5 %	100,0 %
65 or older	28,3 %	71,7 %	100,0 %
ISCO Group			
1 – Managers	96,2 %	3,8 %	100,0 %
2 – Professionals	96,3 %	3,7 %	100,0 %
3 – Technicians and Associate Professionals	94,9 %	5,1 %	100,0 %
4 – Clerical Support Workers	93,1 %	6,9 %	100,0 %
5 – Service and Sales Workers	85,8 %	14,2 %	100,0 %
6 – Skilled Agricultural, Forestry and Fishery Workers	77,5 %	22,5 %	100,0 %
7 – Craft and Related Trades Workers	80,4 %	19,6 %	100,0 %
8 – Plant and Machine Operators and Assemblers	82,4 %	17,6 %	100,0 %
9 – Elementary Occupations	72,4 %	27,6 %	100,0 %

Source: VŠIT

61% of respondents across all groups used online banking in the last three months. In this case, we were struck by the significant difference in the use of online banking by men (66%) and women (58%). Even in the case of this indicator, we revealed a clear connection with education – university students use online banking in 86% of cases, people with

apprenticeship certificates in 50% of cases. Similarly, the connection between this concept and age is not surprising. Online banking is most often used by young adults aged 25–34 years (95% of cases). The use of online banking then decreases with age, with the usual turn around the age of 50 and a minimum of 28% in the oldest age group of 65 and over. Regarding occupations according to ISCO groups, we again see a clear division into white collars using online banking in 90% or more of cases and blue collars, where the use of online banking is around 70 to 80%.

4.4 Summary and recommendations on the digitalization of Czech society

Based on data from the Sample Survey on the Use of Information and Communication Technologies in Households and Among Individuals (VŠIT), this chapter showed how digitalized Czech society is. First, we explained possible reasons why some parts of society reject digitalization using the example of Estonia. We then investigated how the COVID-19 pandemic accelerated the deployment of digital technologies. Finally, we looked at a set of selected indicators in terms of various socio-demographic and employee data.

We found similar trends in almost all cases:

- **Men use digital technology more than women**. However, the gender difference is only minimal in a number of indicators and it can be expected that women will soon catch up with men in their digital loss with the increasing feminization of the university level of the education system.
- **More educated people use digital technologies more than less educated people**. This shows the effects of the Matthew principle (the rich get richer), when people already privileged by higher education gain another advantage in the form of higher digital competences, better knowledge, the possibility of using more modern services, expanding their skills with online courses and the like. In this respect, one cannot expect a spontaneous solution to these problems (which, as we mentioned in the introductory theoretical chapter, dates back to the 1970s, when university students were favoured on the labour market precisely because of their better familiarity with the then emerging computer technology). If trade unions want to improve the competitiveness of less educated employees in the digital labour market, they must strongly push for digital retraining in this direction.
- **Younger people use digital technologies more than older people**. It is surprising that the turning point is about fifty years of age in most indicators. At the time when computer technology massively invaded Czechoslovakia, today's people in their fifties were between twenty and thirty years old and should have been at the peak of their cognitive abilities and desire for education. Surprisingly, they did not transform these advantages into knowledge of computer technology. It is to be hoped that thanks to natural development, they will leave the labour market for regular or early retirement pensions before all jobs are massively digitalized.

- **White collars use digital technology more than blue collars.** It could be assumed that this difference is mainly due to the different use of computer technology and digital technologies in general in individual types of occupations. However, this view is short-sighted and it already turns out that even manual occupations of blue collars are being digitalized very quickly. An example can be a maintenance worker, auto mechanic, gas boiler repairer and similar, formerly purely manual occupations the performance if which now includes working with industrial computers, digital controllers and other advanced technologies. Therefore, even in this case, trade unions must push for further education of manual occupations as part of lifelong improvement of skills according to current developments. Otherwise, manual workers of older age will soon be pushed out of the labour market by their younger and better educated counterparts. The value of the length of experience will rather lose its importance due to the change in the content of individual occupations.

5. Impact of digitalization on selected occupations

There are a number of articles in both quality and popular media that predict with absolute certainty the fate of selected occupations after the digital technological change is fully implemented in the labour market. However, the analyses of various consulting companies also deal with the same topic. According to these articles, the deployment of robots, digital technologies and artificial intelligence will completely abolish certain occupations and at least significantly transform others.

From the above sources, we selected several occupations or groups of occupations on which most of the sources agree. We then tried to explain what impact and in what time frame the introduction of new technologies will have on each of them. In the second step, we investigated the occurrence of these occupations on the current Czech labour market and the socio-demographic characteristics of people who perform these occupations. The description below is therefore three-tiered. The first tier is based on external analyses (with varying degrees of validity) or their research. The second tier is based on our interpretations of the labour market and technological changes. We used the Labour Force Survey for the Czech Republic for 2020 in the third tier to determine the socio-demographic structure of the given group of employees.

The Labour Force Survey is a quarterly survey conducted by the Czech Statistical Office. The research sample is compiled by a multistage stratified selection so that it is representative of the adult Czech population. One fifth of the sample is replaced each quarter so that each respondent appears in the sample for five consecutive quarters. The research proceeds in such a way that first the household is selected and then all persons living in that household are examined using a questionnaire survey. Along with the Labour Force Survey, a Sample Survey on the Use of Information and Communication Technologies in Households and Among Individuals (which we used in some of the previous chapters) is also carried out within the second quarter of the calendar year. The results of the Labour Force Survey are then transmitted to Eurostat which publishes them after harmonization and cleansing together with similar surveys for all European countries as the EU Labour Force Survey.

We selected respondents aged 25–64 years, approximately corresponding to people active in the labour market, from the data set for 2020. The resulting sample consisted of 24,700 respondents, 49% of men and 51% of women. Only 6% of people in this age group have lower than secondary education (primary or incomplete), 35% of respondents have an apprenticeship certificate, 36% of respondents have a SSLC and the remaining 23% a university diploma.

Thus, there are four sub-microanalyses that deal with the occupations of driver (and courier and everything that is associated with driving a motor, non-motorized or rail vehicle), sales worker, call centre workers and workers in the banking and insurance sector.

5.1 Vehicle drivers

At first glance, it might seem that driving is an occupation that is rather on the rise. Indeed, the volume of goods, especially food, ordered via the Internet and transported by some form of motor vehicle increased during the COVID-19 pandemic. The boom in food delivery and the

progressive development of online shopping are making the driver's occupation a growing segment of the labour market.

In addition, driving is a very low-threshold occupation. Basically, all you need is a driving licence, which is issued after completing driver training, simple tests, practical verification of driving skills and an easy health check. Those interested in a driver career do not have to spend many years obtaining the necessary education or specialized skills.

A special chapter are platform drivers who, in addition to a driving licence, also need to have their own car in many cases. Those who want to carry out passenger transport are often forced to undergo the demanding tests of a taxi service operator. Meeting the first condition is probably not difficult due to the general Czech custom of owning at least one car in each family. So why should drivers be threatened by the development of technology?

The first of the big changes that technology brings to drivers' work has already taken place. The development of reliable navigation systems that work in city centres, especially those that display information about current traffic restrictions, traffic jams and detours in addition to the shortest routes, has made previously dreaded toponymy taxi tests a useless piece of paper. Why should an aspiring taxi driver spend months memorizing all sorts of streets and monuments when they can find the same information in a few fractions of a second on their smartphone? Technological change, as in many other cases, has preceded the legislative change, so a large number of world cities require a driver to pass a taxi test for any contractual transport of passengers.

The second change is the advent of self-driving (autonomous) cars. Intensive commercial tests show that the car is now able to move safely in the normal traffic of American cities if the lighting and temperature conditions are ideal for it.

It is therefore a matter of the very near future when autonomous vehicles will move from the phase of public commercial tests and various driver assistants to the form of full commercial deployment. From the perspective of professional drivers, there are two options for further development, neither of which is very positive.

Firstly, there is the possibility that technological and legislative aspects will be resolved so satisfactorily that cars will be able to move completely independently in traffic. A classic driver becomes a useless occupation. A less drastic form of this option is the reservation of a part of cities for the movement of autonomous vehicles (for example, the narrowest centre or, conversely, only residential outskirts with minimal traffic). In this case, there will be no complete liquidation of the driver occupation, only a decrease in the number of people who will be needed to perform it.

Secondly, we can assume that all problems will not be overcome and a safety driver will have to sit in the car while driving to supervise the car and intervene in the driving if necessary. This raises the question of what skills this driver will have to have and whether their employer will suffer from the fact that the driver will actually a front passenger for the same salary all working hours. Especially in the case of truck convoys moving on motorways, it can be expected that only the safety driver in the first truck will be important because only they can get to the solution of real traffic situations. Safety drivers in other trucks will only watch their vehicle following the vehicle in front of them. There are half-hearted debates about whether such drivers should extend their skills and devote themselves to some other occupation during the supervision of a self-driving car.

Of course, the situation does not apply only to motor vehicle drivers. A similar problem will be solved e.g. by an engine driver who will be displaced by the combination of the European Train Control System (ETCS) and properly equipped locomotives to the position of safety drivers who only control how the train slows down and accelerates according to the track settings and timetable.

According to the Average Earnings Information System (ISPV.cz), about 150,000 Czech employees were classified as ISCO 831 – Locomotive Engine Drivers and Related Workers, ISCO 832 – Car, Van and Motorcycle Drivers and ISCO 833 – Heavy Truck and Bus Drivers in 2020. This finding is approximately matched by statistics from the Labour Force Survey, which reports about 3.25% of employees in these categories.

96.4% of men and only 3.6% of women fall into this category. These occupations are held by 6.5% of all men and only 0.2% of all women. Of all persons who perform the work mentioned in the previous paragraphs, 66.2% have secondary education with an apprenticeship certificate (or lower education) and 31.3% have secondary education with a SSLC. Higher education is rather exceptional among drivers. Older groups over 40 years of age are more represented among the age groups. The proportion decreases slightly after reaching the age of 60.

Therefore, we can state that it is not necessary to achieve a higher level of education for the pursuit of the driver occupation and that this occupation does not have an age limit. It is mainly performed by men.

Table 5.1: Characteristics of employees working as drivers

Characteristics	Share
Gender	
Male	96,4 %
Female	3,6 %
Total	100,0 %
Education	
Apprenticeship and lower	66,2 %
SSLC	31,3 %
Higher	2,5 %
Total	100,0 %
Age group	
25–29 years	8,0 %
30–34 years	8,5 %
35–39 years	8,7 %
40–44 years	14,6 %
45–49 years	16,9 %
50–54 years	15,3 %
55–59 years	16,8 %
60–64 years	11,3 %
Total	100,0 %

Source: VŠPS

5.2 Sales workers

The second group of employees that we decided to pay special attention to are sales workers. This occupation has already been significantly transformed by the onset of supermarkets, when there was a transition from specialized sales workers with the knowledge of the goods that they sell to universal employees able to fill the shelves with any products, to stand in when receiving or restocking goods and, if really necessary, for cashiers when in contact with customers.

However, the contact between the sales worker and the customer is limited. It is self-service by the customers. They select goods from the prepared shelves according to their own choice and find out information from the packaging that they had to ask a specialized sales worker for years ago. They transport the goods by themselves to the cash register where – especially recently – they scan the goods into the cash register and pay at the automatic cash register.

From the above, we can see that all important professional knowledge and personal skills that could perhaps have been rewarded by the business operator as higher and non-routine skills are gradually losing their importance. The sales worker may no longer have a thorough knowledge of the goods sold because the customers find out for themselves. Furthermore, the sales worker does not need any sales skills, they do not have any influence on the purchase of goods by the customer in the environment of a modern large shop. They may not be able to deal with people at all because they do not come into contact with customers when offering goods and selecting them or when entering purchased goods into the cash register and paying for them. The role of a sales worker is gradually transformed into the warehouser. In addition to restocking goods and refilling shelves, technology takes over all their roles.

Online shopping is a separate section of the trade sector; it is on the rise as the Internet develops (see the chapter on the digitalization of Czech society for more details, where we also provide statistics on the use of various services). Traditional sales workers no longer have a place there. Customer selects the goods on a website where they also obtain all information about the goods. In this case, the sales workers' sales skills are replaced by the advertising skills of the online shop employees. Using price comparators, the customer can find out whether they pay an excessively high amount for the selected goods. The order is made by clicking on the website, the goods are delivered by the courier (see the previous subchapter on drivers). Instead of sales workers with sales skills and knowledge of goods, only online marketers, warehouse helpers able to search for goods on shelves and pack them and the already mentioned couriers are involved in the purchase process.

Thus, technology is gradually replacing the work of sales workers at all stages of sales. The selection of goods and obtaining information about them is replaced by websites available from anywhere and at any time via a computer or mobile phone. The customer can order goods or services using the touch panel in some shops or take the goods from the shelves and put them into baskets in others. Although low-skilled sales workers or warehouse helpers are used in the second phrase, the search for goods in the warehouse, the impact of technology is beginning to be noticeable here as well. For example, Zásilkovna, a Czech transport service, recently deployed autonomous vehicles for sorting goods in the warehouse. Footage from Amazon's fully automated warehouses is also very well known on the Internet. So far, the transport of goods is dealt with either by the customer or by a courier service system. Self-

service boxes for picking up parcels are starting to be used and autonomous cars are literally waiting at the door. Also, the payment system is cashless and fully automated in most cases.

According to the Average Earnings Information System, the ISCO 5223 Shop Sales Assistants occupation was performed by about 133,000 people. We came to a similar conclusion by searching for the relevant ISCO code in the Labour Force Survey, where it accounts for 2.68% in the 25–64 age group. The characteristics of this group according to the Labour Force Survey are summarized in Table 5.2.

16% of sales workers are men and 84% are women. 0.9% of all men active in the labour market perform this occupation and 4.4% of all women active in the labour market perform this occupation. In terms of the highest level of education attained, the vast majority of sales workers have secondary education without an apprenticeship certificate (54.9%, another 5.7% have only primary education), about a third have secondary education with a SSLC. Higher education is rather exceptional for regular sales workers. The most strongly represented age group is the group of 45–49 years and then 55–59 years. Most sales workers are in the 40–59 age range.

Table 5.2: Characteristics of employees working as sales workers

Characteristics	Share
Gender	
Male	16,1 %
Female	83,9 %
Total	100,0 %
Education	
Apprenticeship and lower	60,6 %
SSLC	35,6 %
Higher	3,8 %
Total	100,0 %
Age group	
25–29 years	9,4 %
30–34 years	9,5 %
35–39 years	9,5 %
40–44 years	13,4 %
45–49 years	19,5 %
50–54 years	14,9 %
55–59 years	16,1 %
60–64 years	7,7 %
Total	100,0 %

Source: VŠPS

5.3 Call centre employees

The third group that we pay attention to are call centre workers. These are people involved in the sale of goods and services by telephone, providing information and customer support or conducting marketing research. These are a wide range of activities falling within the trade and services sectors. They all have low requirements for skills, health and physical abilities;

people without higher education can work in the call centre, so can workers with disabilities, impaired working ability and a number of other handicaps.

As technology was gradually introduced, automatic answering systems were first deployed. The customer called the information line, where a pre-recorded welcome message was played. It usually included an offer of other options and the caller could choose using pulse dialling, i.e. the tone emitted by the phone button when someone presses it. After making the choice, the caller moved to the next level where they again heard some introductory information and had the opportunity to make further choices. By appropriate layering, the operator could create a system in which the customers could obtain most of the information themselves, could make changes to the service settings, etc. Only a fraction of calls reached live operators: those that could not be resolved by self-service and where consultation with a human employee was really necessary.

There were also experiments with the deployment of artificial intelligence capable of recognizing the customer's request from their speech. The system first translated the spoken language into written form in which it tried to identify certain keywords. It continued to work based on them. This system did not worked very well in the environment of a complex Czech language. However, artificial intelligence is developing at a high speed and as examples of various smart speakers (Alexa) or mobile assistants (Siri, Google Assistant) show, such a solution is no longer completely impossible. The development of ChatGPT artificial intelligence, which is able to conduct a meaningful conversation with the user (although only in written form) on virtually any topic, will also have a great impact.

In this case, the development of the Internet and websites also intervenes. What customers used to do by phone e.g. with their banker and later partly automatically with an automated telephone banking line, they can now easily do through websites and online banking.

Table 5.3: Characteristics of employees working as call centre operator

Characteristics	Share
Gender	
Male	29,2 %
Female	70,8 %
Total	100,0 %
Education	
Apprenticeship and lower	15,4 %
SSLC	69,2 %
Higher	15,4 %
Total	100,0 %
Age group	
25–29 years	13,9 %
30–34 years	18,5 %
35–39 years	20,0 %
40–44 years	10,8 %
45–49 years	18,5 %
50–54 years	9,2 %
55–59 years	6,2 %
60–64 years	3,1 %
Total	100,0 %

Source: VŠPS

If we look at the structure of employees in call centres, these are employees performing the occupation of ISCO 5244 Contact Centre Salespersons and ISCO 4222 Contact Centre Information Clerks. According to the Average Earnings Information System, these occupations were performed by about 18,000 people. According to the Labour Force Survey, these employees accounted for about 0.26% of people active in the labour market.

As summarized in Table 5.3, about 29% of women and 31% of men work in call centres. Call centre employees account for about 0.16% of all men active in the labour market and about 0.36% of all women active in the labour market. In terms of education, secondary education with a SSLC is the most represented, reported by 69% of call centre employees. Apprenticeship, along with primary education, accounted for about 15%; university students also accounted for the same share in this sector of human activity. Call centre employees are younger rather than older. The most strongly represented group are people aged 35–39 years. Although people of pre-retirement age could find a physically undemanding occupation in call centres, the share of employees between 50 and 59 years of age is only 15.4%.

5.4 Banking and insurance sector

A special group that is usually mentioned in texts on technological deformation of the labour market are bank employees. Although they perform relatively skilled work that cannot be easily replaced by any algorithm. On the other hand, as in the case of sales workers, it is very easy for customers to replace them.

Self-service systems of all kinds are to blame. We can talk about ATMs that allow us to withdraw (and relatively newly deposit) the necessary amount from (to) your bank account at any time. The next step was telephone lines capable of automatically providing information not only on banking services, but also on the account status of the calling client or – after appropriate verification – to carry out active operations. Websites and mobile applications that allow complete control of all banking services came naturally along with the development of the Internet and mobile phones.

The role of bank officials changed earlier due to the introduction of technology, towards higher skills. Instead of simple operations involving the withdrawal and deposit of funds or the provision of information about services, these employees are now moving into the role of personal bankers and personal financial advisors. They try to create a mix from a wide range of different banking products for their clients that would best meet their needs. This is at least what the banking staff tell their clients, although it is obvious that the amount of commission for their negotiation will also play a role in the selected products.

For this reason too, it is likely that narrowly focused artificial intelligence will replace the role of the live banker. Based on a simple and natural language interview with the customer, it can find out what their financial needs are and create a tailor-made service offer. The accuracy of such a solution will be further improved if, in addition to the interview, artificial intelligence also analyses account statements or if it is able to monitor the customer's behaviour for a long time, e.g. through their mobile phone.

This scenario does not have to mean the end of human bankers, financial advisors or insurers. Artificial intelligence is also accessible to them and it is more likely to be acquired by bankers

and advisors, especially if its operation requires some deeper knowledge or is associated with the payment of some fees. They would get a handy tool for their own work.

The result is likely to be a combination of both approaches. An ever-decreasing part of clients will go to the bank to see their personal banker and solve their financial needs with them (similar to the decreasing part of clients who do not use online banking). The personal banker will probably evaluate the needs of such clients and offer them a suitable solution partly by themselves, partly using various artificial intelligence tools. The second part of people, the size of which is likely to increase over time, will handle it on their own. Either they consult their needs with artificial intelligence on a one-off basis and follow its recommendations or they entrust the management of their financial affairs completely to the service and will not worry too much about its specific steps.

It should be noted here that this scenario does not apply exclusively to financial services. We can certainly imagine that a similar division of the population into two groups will occur in the health sector for example. Many people already consult their health problems with websites. If they were given the opportunity to talk about them with artificial intelligence, it would certainly increase their confidence in online treatment. There is a possibility of combined services that solve common, less serious problems, such as colds, via the Internet, moderate cases by a combination of the Internet and blood analysis or other tests and a live doctor will solve only the most serious cases (least easily solvable by artificial intelligence).

Table 5.4: Characteristics of employees working in banking and insurance

Characteristics	Share
Gender	
Male	39,0 %
Female	61,0 %
Total	100,0 %
Education	
Apprenticeship and lower	3,4 %
SSLC	53,7 %
Higher	42,9 %
Total	100,0 %
Age group	
25–29 years	11,2 %
30–34 years	13,7 %
35–39 years	16,1 %
40–44 years	19,0 %
45–49 years	16,6 %
50–54 years	6,8 %
55–59 years	9,8 %
60–64 years	6,8 %
Total	100,0 %

Source: VŠPS

According to the Average Earnings Information System, the occupations classified as ISCO 3312 Credit and Loans Officers, ISCO 2412 Financial and Investment Advisers and ISCO 3321 Insurance Representatives employed about 24,000 people in 2020. According to the Labour

Force Survey, this represents 0.83% of people active in the labour market, which is roughly twice the value indicated. The characteristics of these persons are summarized in Table 5.4.

There are 61% of women and 39% of men among the employees in the banking sector. 0.67% of all men active in the labour market fall into this sector. 0.98% of all women active in the labour market fall into this sector. The most common level of education achieved is secondary with a SSLC, which is reported by 54% of employees in banking and insurance. 43% of people in this field can boast of a university education. Lower education is only exceptional. In terms of the age structure, the groups of 40–44 years and 35–39 years are the most represented, along with 45–49 years. These three adjacent age groups comprise more than half of the employees.

5.5 Case study summary

This subchapter presented four case studies of occupations or groups thereof that, in the opinion of experts, will be most affected by the introduction of technology, digitalization or artificial intelligence. These are drivers, sales workers, call centre workers and workers in banking and insurance.

For individual case studies, we have explained how technology interfered in the past, is currently intervening and will interfere in the occupations in the near future. We have also added a basic socio-demographic profile of people in these occupations.

As a result, we must support the task-biased technological change of the labour market and the concept of technological turn. It turns out that the use of technology threatens the jobs of all socio-demographic groups – men and women, less and more educated persons, young and old ones. Rather it depends on the content of the relevant occupation and the ability of its performers to adapt to the upcoming changes, to use them as best as possible in their occupation for their own benefit.

6. Selected problems of the digital labour market

The basis for the elaboration of this chapter are the results of our analyses, which we have already presented in previous chapters, and various forecasts and analyses published by prestigious economic media and consulting companies. The assumptions about which occupations will be replaced by machines began to appear to a greater extent especially after the publication of the ChatGPT language model.

We tried to distil several problems associated with further digitalization, robotics and deployment of artificial intelligence, which in our opinion are significant or will become significant in the near future, from the materials mentioned above.

6.1 Robotics in manual jobs

This is a phenomenon that has been observed in the labour market since the beginning of the Industrial Revolution, which developed more in the 1970s and which has been accelerating significantly recently. This is especially true with the development of collaborative robots (cobots) and autonomous industrial vehicles. The possibility of deploying an independent robot in the production lines among human employees, in their former place, without the need to rebuild the entire line or secure the robot with special barriers, allows for a gradual rebuilding of the production line from fully occupied by human workers, through partially occupied by cobots, to fully robotized.

Since a collaborative robot can already handle most of the tasks usually performed by production workers with its arms, the only problem remains its price. On the one hand, there are the costs of acquiring the robot, its service and operation, on the other hand, the costs of building a job with appropriate parameters, acquiring an employee, their training and wage costs.

Nothing will stand in the way of the gradual displacement of unskilled and semi-skilled employees and their replacement by machines at the moment when the economic side of the matter is more advantageous for the deployment of robots.

This can bring two important changes. First of all, it is a transformation of the maintenance occupation, when a regular locksmith or electrician will no longer be enough to manage the robotic production line, but it will be necessary to recruit employees capable of at least basic programming.

Furthermore, with decreasing costs of deploying and operating robots, there may be a situation where robotic production in European countries is cheaper than production in countries with cheap labour and subsequent transport of products or their parts to the other side of the world. This may threaten in particular those parts of the Czech industry that serve as production and assembly plants for semi-finished products for further processing in other countries – suddenly it will be easier to replace the ‘cheap Czech worker’ with the equally expensive ‘German robot’.

Suitable solution to this problem is the further pressure of trade unions in collective bargaining on wage growth. Furthermore, this problem will be prevented by increasing the skills of the workforce and increasing the complexity of industrial production. If the Czech Republic ceases to be a country of 'cheap labour' and a country of 'assembly plants' and is able to offer a highly skilled workforce and production with high added value on the global labour market, it will benefit from the robotics in manual occupations rather than suffer significantly from it.

Retraining is the most appropriate solution for current employees. The ability to perform any work other than the simplest manual tasks will give employees the opportunity to avoid their job being replaced by robots for longer time. The final solution is to move employees from the industrial sector to the personal services sector, which – so far – seems to be the only one that will resist robotics for a long time. Especially because the aging of the population is expected in the Czech Republic and other developed countries, which will entail the need for increased care in both the public and private sectors.

6.2 Automation of communication with customers

The trend, which is already noticeable to a large extent in the Czech Republic, is the automation of contact with customers. Supermarkets deploy automatic cash registers which, under the supervision of one cashier, perform work that was done by eight other cashiers a few months ago. Fast food restaurants are largely equipped with ordering kiosks where the customer chooses their own food and drink, sends the order to the kitchen and can even pay for it. Even regular restaurants and cafes have a QR code placed on their tables to allow automatic payment of consumption via a mobile phone without the need to use the services of waiting staff. Both mobile operators and banks install automatic systems on their customer telephone lines for customers to easily obtain the necessary information, change service settings or order new services. Websites or specialized mobile applications that appear across the spectrum of individual industries – carriers, retail, services, etc. – have the same role.

The common denominator of all the above changes is a significant reduction in contact between customers and employees. The service operator or the shop / restaurant owner will save significantly on their own staff. The cost of operation is passed on to the customer, who still takes it as a huge advantage. They have more control over the order, the feeling that they can affect its form and course more, they enjoy the opportunity to make orders from the comfort of their home and have them available at any time on their computer or mobile phone.

Creating a complex ordering system does not require the deployment of advanced artificial intelligence or other technologies. It is based on common programming technologies and websites available for a long time. It can rely on the widespread penetration of the Internet and smartphones and the willingness of users to use these technologies. Naturally, there are cases of deploying humanoid robots that are able to greet the customer by voice, show them an offer on a tablet and accept their order from the customer. Ordering systems are implemented without any problems and greater costs even without them.

A significant reduction in the number of employees dedicated to customer communication can be expected in the short term. Their complete destruction is not yet possible because there is still a certain part of customers who do not know, do not want or cannot use digital self-service technologies (see the relevant chapter on the digitalization of Czech society for more details). However, it can be expected in the medium term (the exact scope of which depends on the target group of a particular service provider) that automatic ordering and information systems will completely displace human employees.

The solution to this problem is exclusively to increase or change the skills of the relevant employees. People whose only (or essential) job was to transfer the customer's wishes to a computer must learn to perform other tasks.

6.3 Routinization of 'intellectual' work

Both of the above-mentioned problems were already described in the skill-biased technological change or routine-/task-biased technological change theories, as described in the introductory theoretical chapter. However, at the time of their formulation, there were still a number of occupations that required relatively high skills (and were thus safe from being pushed out of the labour market due to replacement by simple machines) and were certainly not routine (and were thus safe from being pushed out of the labour market due to replacement by computer technology).

The latest developments in the field of artificial intelligence show that our idea of a skill-intensive and creative occupation will have to be fundamentally changed. Especially the services made available to the public within the Open AI platform show that these occupations are definitely not safe from technological change.

ChatGPT is a language model that allows creating new texts based on prompts containing appropriately formulated questions. We are not able to see the possibilities of its use at this moment, but we already know that it can prepare a text on any topic (and replace the activities of journalists), summarize the ideas of several other texts (and replace the activities of teachers, writers of professional books), solve mathematical tasks, compare several different approaches in a sophisticated way, design pieces of computer programs in different languages (and replace the activities of programmers).

The DALL-E sister platform handles the generation of images or photos according to the verbal assignment (and thus handles the work of illustrators or photographers). At the time of preparing this text, a new platform, SHAP-E, appeared, which can create 3D models (and thus largely replaces the work of designers and similar strictly creative occupations).

There is a lot of funny information on the Internet about how the above models got it wrong. Photographs containing artifacts in the form of a third ear or artificial teeth hovering over a romantic corner with a pond and a reflection of the moon. Texts containing fictitious information or referring to non-existent sources.

But there are two things to be aware of. A machine is only as good as the people who taught it how to do it. It is not that artificial intelligence makes mistakes; it only means that also

people make mistakes. As part of cognitive bias, we often expect perfection from computers that we would never expect from a human. However, the goal is not to create perfect artificial intelligence, it will be enough to disrupt the labour market if artificial intelligence is as good as the average person. Secondly, artificial intelligence is improving at a tremendous rate. Whoever saw the first attempts with ChatGPT in April this year is surprised by the progress made by May or June.

After all, we can look at the example of language translators such as Google Translate or DeepL. These have been available to the general public for many years and they made an incredible progress in the quality of translation, especially in the last year. From ridiculed generators of meaningless phrases like '*drahoušek zákazník*' (bad translation of '*dear customer*' where the Czech word '*drahoušek*' means '*sweetheart*'), they have developed into a full-fledged replacement for professional human translators.

The solution to this problem probably does not consist in increasing the skills of the representatives of the relevant occupations that are already at a high enough level. On the contrary, it is advisable to focus on the degree of creativity. Accept the existence of artificial intelligence that can do routine and less creative work (although we still thought it was non-routine and highly creative work) faster, cheaper and definitely better in the near future. And focus the offer on services where artificial intelligence is not yet sufficient. Learn to use it to quickly process routine parts of a given task and devote human strength and skills exclusively to non-routine ones.

6.4 Flexibilization and platform work

The growing share of people working in non-standard[16] jobs confronts us with the question of how to actually define the term employee, employment today and how to rethink the relationship between employer and employees.

First of all, these are employees with non-standard employment contracts. On the one hand, it is desirable that employers offer part-time jobs that are easier to balance with family life, caring for loved ones, hobbies, illness or other problems. On the other hand, such employees lose a number of benefits that are more accessible to full-time employees. In the extreme case, it is the absence of the possibility of taking leave or sick leave and the absence of pension security scheme (applies in particular to agreements to work outside employment). Research shows that employers prefer full-time employees in many cases if they decide who will be allowed to increase their skills through training, who will be promoted or who will be sent on a business trip, for example. Part-time employees thus lose both financial and non-financial

[16] This means in any way different from a full-time and indefinite employment contract; this includes fixed-term contracts, agreements to work outside employment, part-time work, agency employment, false self-employment, work through an application or an Internet platform, etc.

rewards associated with the employment compared to their counterparts. Not to mention the reduced level of security associated with the temporary nature of the employment.

There are currently political debates on resolving the uncertainties associated with agreements to work outside employment. The result should be better protection for such employees, which should be comparable to the protection of employees with a regular employment contract. However, there are still employees who do not have agreement to work, but a non-standard employment contract in some way (part-time or fixed-term contract). From the point of view of legislation, such employees are not disadvantaged, but it is appropriate to provide them with a higher level of collective protection in the real environment.

The next chapter is about employees performing work on the employer's premises as self-employed, the false self-employment. It brings disadvantages for the state and for employees; employers benefit from it. The state loses higher contributions to taxes, health and social insurance, which are lower when paid by self-employed persons than by employees. The solution to this problem is to change the legislation. On the other hand, employees do not have access to the non-financial benefits associated with standard employment, such as leave, the right to strike, the opportunity to be unionized or retirement security. Also, upon termination of employment, the dismissal of a self-employed person is much easier than the dismissal of a regular employee. All these problems must be solved by employees working in the false self-employment through a system of additional contracts and private supplementary insurance.

Platform work is a special case of self-employment. A new trend of online platforms that bring together small providers is emerging in some sectors, such as transport, accommodation, gastronomy, services or consulting. They advertise their services through the platform, including a price list and the possibility of immediately ordering a service or at least booking a date. Customers choose their provider through the website or mobile application and agree with it on the provision of the service. They will then order it and also pay for it through the platform.

In addition to promoting their suppliers, the platforms also provide a payment system, mutual evaluation of service providers and customers, who can then decide who to use for the service or to whom they will provide it. Other services may include accounting or legal advice, preparation of tax returns, etc. The platform collects a commission from providers for its services.

Providers, as sole traders, are not classic employees and are exposed to similar problems as other persons working in the false self-employment system. Absence of the possibility of taking leave or sick leave, the need to secure means of production on their own account, to secure a pension through savings. Providers of this type usually do not associate in trade unions and if they want to show their dissatisfaction with, for example, the terms of the platform or the currently applicable legislation, they must organize in a different way and on

their own[17]. Termination of cooperation with the platform employee / provider is quick and easy and no protection methods defined in the Labour Code apply to it.

In our opinion, this is a great opportunity for trade unions to work on. So far, they appeal mainly to regular employees and do not focus too much on employees with non-standard employment contracts (part-time, fixed-term, agreements) or employees working in the false self-employment. It is likely that the share of both these groups will grow in the near future. The pressure for flexibility is ubiquitous and tends to intensify. Digitalization and penetration of fast mobile networks allows the introduction of platform services to increasing number of industries in which we could not imagine it for a long time. It is the ability or inability of trade unions to address these 'non-standard' employees and represent their interests collectively that is cited by some authors as a strong reason for the decline in trade union involvement in European countries.

6.5 Bureaucratic change

Changes in the labour market triggered or reinforced by the introduction of technology, digitalization and the progress of artificial intelligence seem to further strengthen the gap between the private and public sectors. A large part of the occupations that may be negatively affected by the above-mentioned phenomena fall within the private sector.

In this case, we are talking about occupations in production (semi-skilled and unskilled workers, agricultural and construction machinery), trade and services (communication with customers, ordering products and services) or non-routine commercial activities considered creative until recently, such as the creation of texts or computer programs. We must not forget about transport of all kinds and logistics. The vast majority of these occupations will be in the private sector.

In contrast, when we consider occupations that will be affected little or not at all by the deployment of robots, digitalization or artificial intelligence, we come to the education or health sectors. These sectors may include new technologies as an integral part of their work, but we cannot expect our children to be educated by artificial intelligence in the near future. Of course, we can assume that doctors will use artificial intelligence as a handy diagnostic tool, that artificial intelligence will evaluate large data collected, for example, by smart watches and predict the risks of various diseases in advance, that artificial intelligence will help to evaluate X-ray or sonographic images. Similarly, we must expect that teachers will have to deal with the possibilities offered to students by ChatGPT in the field of possible generation of seminar papers and that they will be able to use similar tools to prepare better study materials. However, we do not expect the disappearance of doctors or teachers and their replacement by automatic robots in the near future.

[17]Examples include protest rides by Uber platform taxi drivers or Wolt food delivery drivers.

Clerks in state administration are a special case. As digitalization progresses, they could be largely replaced by automatic information systems, such as in commercial banking. The fact that a large part of people submit tax returns electronically in a machine-readable format should logically lead to a significant reduction in the number of tax officials who are reserved for the receipt of paper forms and their processing and checking. But experience shows that the number of state officials is not decreasing along with the ongoing digitalization of the state administration.

Sociologists use the bureaucratic change biased technological change theory to interpret this phenomenon. The increasingly expanding welfare state is able to absorb more and more graduates in its bureaucratic apparatus. In addition, it stipulates the condition of higher education for occupations where there was no need until recently (typically kindergarten teachers, nurses, higher-ranking police officers, clerks, etc.). As a result, a large proportion of highly skilled workers will be employed in the public sphere and will be protected against the risk of being replaced by technology by their university education, the characteristics of their occupation and state decisions. On the contrary, there will be employees in the private sector whose occupation is more easily replaced by machines and not protected by employers against this risk due to their economic interests and who, in many cases, do not have sufficiently high skills to protect themselves against it.

6.6 Summary of selected problems in the digital labour market

The previous subchapters gradually introduced five problems that we consider fundamental in the digitalized labour market. The first axis of the interpretation ran along the skills scale. We have shown that low-skilled workers who perform manual work can soon be replaced by robots. Employees with intermediate skills working in contact with customers are already replaced by self-checkouts and Internet or mobile applications. Highly skilled employees who have so far performed relatively creative work are being replaced by emerging artificial intelligence.

A common possibility to combat the three problems is to increase the skills of employees and increase the price of labour in the Czech labour market. In this respect, trade unions can help by their collective bargaining with employers and the state and by offering retraining services to their members.

The other two problems relate to the growing proportion of employees without a standard, full-time and open-ended contract. These are various types of part-time work, contract work or even self-employment, employment through agencies and platforms.

The interests of these employees cannot be represented collectively by trade unions and trade unions should be more open to these non-standard employees as part of changes in the labour market.

Conclusion

This final chapter will first summarize the findings of the previous chapters. Subsequently, it will make recommendations that, in our opinion, trade unions could follow to mitigate or completely eliminate the negative impact of the introduction of robotics, digital technologies and artificial intelligence in the Czech labour market.

Summary of the results

We presented the broader macroeconomic context of the current Czech Republic in the first chapter. We are witnessing uneven development of the economy, whether in terms of sectoral or regional division. While real value added in some sectors has quadrupled or almost quintupled in the last 27 years, many other sectors are well below 1995 levels in 2022. This also has an impact on the development of the sectoral structure of the economy. The importance of sectors according to ownership (divided into the national public sector, the national private sector and the foreign-controlled sector) also differs, both at the level of the entire economy and its individual sectors. We have been drawing attention to the outflow of primary income abroad for a long time; the ratio of the net primary income balance to GDP is one of the highest in the EU countries and, with a similarly high GDP per capita, means a lower standard of living for households. We draw attention to the continuing regional divergence measured by GDP development at the end of the macroeconomic chapter.

The second chapter contained an overview of the historical development of the introduction of technologies to the labour market, appropriate theories and solutions and the introduction of important concepts. We emphasize in particular the concept of precarization and flexibilization referring to non-standard types of employment, so far underrepresented by trade unions. Precarization takes on a new dimension in the form of platform work in connection with the introduction of digital technologies. These need to be given careful attention by the trade unions.

The third chapter investigated what characteristics of employees affect their membership in trade unions. We concluded that men are more likely to join unions than women, university students and teachers than graduates, blue collars than white collars and people in the public sector rather than people in the private sector. It is necessary to work with this distribution of forces and, on the one hand, to collectively represent the interests of these types of employees and, on the other hand, to focus the acquisition efforts on groups not yet represented.

The fourth chapter dealt with the problem of digital skills in the Czech society. It revealed the strong impact of education and age, when it is true that people with higher education and people of younger age use all types of digital services significantly more often than people with a lower level of education or higher age. Regarding age, approximately the fiftieth year of human life is the turning point. After crossing this threshold, the use of all kinds of digital services is declining rapidly.

The fifth chapter contains several case microstudies dealing with occupations or groups thereof that are expected to be threatened by the deployment of technologies in the immediate future.

The sixth chapter followed on from the results of the analyses and shows several general problems that robotics, the deployment of digital technologies and the development of artificial intelligence will bring. Gradually, we showed the impact of robotics on the unskilled workforce, the impact of digitalization on the workforce working in contact with customers and the impact of artificial intelligence on jobs that until recently were considered safe and creative. We identified the transformation of employee relations towards less standard forms of cooperation and bureaucratic change with many jobs unaffected by digital change remaining in the public or state sector, as the main transformations of the labour market.

Recommendations

Based on the findings in the previous chapters, we recommend trade unions to focus on the following three areas in order to mitigate the negative effects of technology introduction in the Czech labour market:

Skilled workforce

A number of our analyses have shown that digital technologies are used much more often by employees with higher skills. Higher skills also give greater opportunities to adapt to changing conditions on the labour market and entail a number of positive financial and non-financial consequences for individuals and society as a whole.

Although it is no longer true that people with a university degree are safe from the disruption of the labour market due to technology because artificial intelligence can also replace their work in many cases, they are at least better protected. They can use artificial intelligence as a useful tool and entrust it with routine parts of their work tasks. They are able to shift their skills (e.g. in the form of Internet education) in such a direction that they can devote themselves to activities that artificial intelligence cannot replace.

Especially in the context of Internet education, it is alarming how employees with lower education do not use this option. The comforting claim that 'all these robots will need their maintenance technicians' is of limited validity. The job of a robot maintenance technician will require a different set of skills and knowledge than the job of a lathe maintenance technician, for example. New skills will have to be both interdisciplinary, as the robot is a combination of at least electrical engineering, mechanical engineering and computer science, and necessarily include programming knowledge. The same applies to the operation and maintenance of other machines and equipment, starting with modern cars and ending with household appliances. Everything has a computer in it today and today's maintenance technicians certainly need more that the knowledge they acquired at the vocational school in the 1980s or 1990s.

Price of Czech work

Although the deployment of a robot or computer with artificial intelligence seems to be economically advantageous, in fact, such a robot or machine is a means of production in a developed capitalist society, just like an employee, and must pay off economically to its operator. Thus, aspects such as the purchase price, which naturally decreases over time, the price for service, which is higher than for other machines due to the above-described requirements for employees with higher skills, and the price for operation come into play. The other side of the equation features the cost of employees, their acquisition, training,

continuous payment and maintenance of a job in parameters suitable for humans (e.g. with sufficient lighting, air supply and other necessities that are not usually required by robots).

If the cost of operating robots decreases and the cost of human labour increases, it will be worth it for employers to entrust part of the production to a robot at one point because it will be cheaper than filling these jobs with human employees.

Trade unions trying to enforce higher wages for employees must therefore also take this aspect into account. And try to increase wages only to a certain extent, in connection with the added value of the work performed. Higher wages may be associated with high-skilled employees and with the performance of activities that are difficult to algorithmize and thus entrust to robots.

As we proposed in the previous subchapter for people with high education, some form of co-existence of employees with robots is ideal. Of course, the routine and strenuous part of the work can be entrusted to machines, but human employees must be sufficiently skilled to use these machines as a complement to their complex and creative activities, which will be significantly better paid.

Rethinking the concept of employment

Many indications suggest that the relatively short period of time when the standard full-time employment was secured by a fixed-term employment contract and associated with a number of non-financial benefits, such as the right to strike, the possibility to take leave or to be secured by social benefits (whether against unemployment or as part of an old-age pension) after leaving the employment relationship is coming to an end.

The development of the labour market heads towards short-term and temporary jobs, which are in line with the ubiquitous pressure for flexibility. The extreme case of such disadvantageous contracts are agreements to work outside employment (alternative employment contracts pursuant to Section 75/76 of the Czech Labour Code).

False self-employment, which lacks all forms of social security and legal protection, is also on the rise. In connection with the advancing digitalization, this form (self-employment) is transformed into platform work, when a person is no longer an employee of a specific employer, but a contractor of an Internet platform or mobile application. It assigns (or does not assign) them a job, takes care of processing and paying for orders.

Trade unions do not yet represent these ‘non-standard’ employees very well. Perhaps they are still recruiting employees with a standard employment contract who have shorter working hours or a limited duration of the contract. However, they rarely accept workers with agreements or even a trade licence.

However, in order to protect employees from the negative effects of digitalization, it is necessary to broaden the concept of what we consider to be an employee and employment. Both on the side of trade unions and on the side of the state, legislation, tax aspects and the like. Here we can see exactly where trade unions and their collective bargaining power can be applied.

To conclude, we would like to state that the introduction of robotics, digital technologies or artificial intelligence is not something that we can or even should fight against. The Czech labour market is too tied to European structures, international organizations and – through the digital technologies we are talking about – the Internet. Despite all efforts, it cannot prevent the arrival of new forms of employment in the long term, as the Czech courts have tried to do in the case of the 'non-standard' taxi service Uber. There is no choice but to learn to live with new technologies and new labour market arrangements, adapt to changes and try to get the best out of them.

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ČSÚ: Databáze národních účtů

ČSÚ: Regionální účty

ISSP: International Social Survey Programme

VŠIT: Výběrové šetření o využívání informačních a komunikačních technologií v domácnostech a mezi jednotlivci

VŠPS: Výběrové šetření pracovních sil