Labor Market Analysis for IT Jobs

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Abstract: COVID-19 had a serious, negative impact on the economy, as a whole, and on the labor market. The situation has improved recently, but it is useful to map the changes in the labor market and current future trends. Many have lost their jobs, due to the crisis caused by the virus situation and many of them have not been able to get full-time jobs, for extended periods of time. In the technology industry, recruitment is increasing. These global labor market findings raise the question of the characteristics of the Eastern European IT labor market. In this article, the job opportunities are compared, in order to determine in which IT areas, the most job opportunities appear and how they relate to different fields of IT, as services, software development, telecommunication, appliances, electronics, human resources or vehicle manufacturing.

Keywords: labor market; IT; engineering; analysis; Romania; Hungary

1 Introduction

COVID-19 has a serious negative impact on the economy as a whole and on the labor market. The situation has improved recently, but it is useful to map the changes in the labor market and current future trends. Many have lost their jobs due to the crisis caused by the virus situation and many of them have not been able to get full-time jobs for extended periods of time. As a result, there is a risk of long-

term unemployment. In many countries, job retention measures have been the main means of mitigating the effects of the crisis on the labor market. Job retention programs have helped curb rising unemployment.

There have been a number of studies of the global labor market situation. One important finding is that today, 79% of job seekers use social media in their job search and this is even higher, among younger job seekers, at 86% [1]. 40 million people search for jobs on LinkedIn every week, 67% of job seekers use Facebook, 73% of young job seekers found their job through a social media platform [1]. 21% of recruiters admit to having already rejected an applicant after searching on Facebook [1]. According to previous studies, 35% of the announced jobs require at least a BSc, 30% have at least an Associate Degree, and 36% do not require education beyond High School [2].

In the technology industry, recruitment is increasing before or during the pandemic at a level beyond that [3]. The most IT jobs in 2022: database administrator and architect, information security analyst, software developer, network and computer systems administrator, computer programmer, web developer, computer and information systems manager, systems analyst, help desk and desktop support professional, network/cloud architect [3]. On the other hand, IT recruiters and executives say cloud, security, data and artificial intelligence skills are among the coolest jobs in 2021 [4].

The article [4], summarizes the most in-demand jobs in 2021: artificial intelligence (AI) specialists, strategy-minded software developers and managers, business-focused data scientists, data engineers, AIOps analysts, engineers, and architects, cybersecurity architects and engineers, cloud architects, IT directors who demonstrate soft skills. These jobs are focusing on special areas of IT. The highest-paying IT jobs in 2022 among others: big data engineer, information systems security manager, data architect, network/cloud architect [5]. From the above, it can be seen that a wide variety of current IT jobs are typical for 2022, both in terms of job search and salary.

These global labor market findings raise the question of the characteristics of the Eastern European IT labor market. In this article, the job opportunities of the authors' countries, Romania and Hungary, are compared in order to determine in which IT areas the most job opportunities appear, and how they relate to the two countries. The analysis was performed using queries based on the job search page of the LinkedIn portal.

1.1 Situation in Hungary

Despite the adverse effects of the pandemic on most areas of the economy, the IT market has been characterized by new investment and rising wages. According to forecasts, the Hungarian IT market is expected to grow, and companies are undergoing digital transformations in several areas. Following COVID, home work was introduced in many places.

In recent years, the role of customer-centric web development has further intensified, with more and more companies recognizing and focusing on UX / UI Designer activities, as the user interface has a strong impact on website traffic. The importance of the IT Security area has increased, so growth is expected in the coming years, and the DevOps area is characterized by a continuous shortage of manpower [6]. Demand for data professionals has continued to grow, but is increasingly gaining a role in Machine Learning and Deep Learning jobs [6].

IT professionals (41%), manufacturing employees (29%) and manual workers (35%) are most affected by recruitment [7]. Company executives said the epidemic did not have a significant impact on their wage payments projected for 2021. 83% of companies use the home office option [7]. The [7] looked at the extent to which working from home could really become the new norm in the post-virus period. 37% of respondents would allow work from home for 1-2 days a week and 22% for 3-4 days at home, but only 5% would be able to switch to full-time work and just over a tenth of companies would return to office or workplace.

With regard to engineering jobs, there were already difficulties in Hungary last year, which was mostly caused by the downturn in the automotive industry [6]. 2020 has not brought about a significant change in wages or skills demand in the manufacturing sector [6]. On the employee side, stability is the main motivation, while for employers, reliability, flexibility and expertise are paramount [6]. In the field of industrial automation, they are constantly striving to improve their manufacturing technology and increasingly to move towards industrial IT and highly automated systems.

Overall, the past labor shortage has only persisted in some parts of the country due to declining demand, with well-educated, highly skilled job seekers providing a number of good job opportunities. Demand for quality assurance professionals has declined, which can be explained by the postponement of new investments and the wait of manufacturing companies [6]. The demand for development engineers is mostly for those with at least 3-4 years of experience who can use multiple CAD programs at a professional level or speak English at a strong intermediate level [6].

1.2 Situation in Romania

In Romania, according to data provided by the National Institute of Statistics, 19.3 million inhabitants were registered at the beginning of January 2021. According to the Labor Register, of this number at national level, 44% represent the active civilian population, and 64.5% of the active population were employed. The majority of employees, namely 63.3% worked in the services sector, 34.3% of people were employed in industry and construction, while 4% were employed in the IT&C sector [13]. The number of employees in forestry, agriculture and fishing was 2.3%. In 2021, the employment rate of the active population was 71.8% for men and 67.2% for women, so on average 69.6% [13].

On the recommendation of the World Bank's country director for Romania, Elisabetta Capannelli, who said in 2014 that Romania must invest in education, given that, although there are some areas of excellence, 15-20% of the population is below the level of elementary education, investments in the education system have increased [8].

The COVID-19 pandemic crisis severely affected Romania's economic activities, such as hotels and restaurants, population services (e.g., transport, cultural activities). The measures taken to support the companies and employees affected (in particular the measures on leave) had a mitigating effect on the negative impact of the crisis. The average number of employees thus reached 4.9 million people in the period January-November 2020, decreasing by only 1.0% compared to the similar period of the previous year [13].

In September 2020, more than 146,000 people applied for a job, of which 30,000 were new candidates who either did not have an eJobs account or had not been active in recent years. In fact, this was the monthly average of the last period - between 25,000 and 30,000 new candidates applying for the first time or for the first time in a long time in which they have not made a professional change. Many of them are very young, i.e., between 18 and 24 years old, and for them the good news is that start-ups and SMEs, some of the favorite employers for this age group, have resumed significant employment.

In 2021, construction has continued to develop favorably in recent years, but at a slower pace. The tertiary sector will also support this growth, especially through the development of modern services (IT, business services). As for the industry, it has partially recovered, being forecast to reach the level of 2019 by the end of 2022. For the agricultural sector, an increase in production of about 15% in 2022 has been forecast.

Romania is divided into eight administrative regions: North-West, Center, North-East, South-East, South-Muntenia, Bucharest-Ilfov, South-West Oltenia and West [14]. Each region has certain specific features in terms of its economic structure, which is why certain sectors play a predominant role in the development of each region.

At the end of March 2021, the highest rates of registered unemployment were in the South-West region (5.3%) and the North-East region (4.9%). The lowest registered unemployment rates were registered in Bucharest (0.9%) and the West region (2.3%) [13].

The COVID-19 crisis did not bypass the IT field either, with a clear impact in terms of the number of customers, contracts, reorganization of the activity, etc. but the sector was less affected than other sectors whose activity was directly affected by the lockdown period or the maintenance of rules of social distance. IT is a versatile industry, which is familiar with and uses up-to-date digital tools, accustomed to a flexible employee schedule involving remote work, so from this perspective at least formally it has not been affected by the changes that have taken place.

Since the beginning of the pandemic, a series of measures have been established in many IT companies in Romania, mainly in Cluj-Napoca, Bucharest, Iasi and Brasov: from technical unemployment and dismissals, to postponing salary increases, reducing meal vouchers and reducing the work schedule [9].

At several companies, there were teams that completely dislocated and, temporarily, went into technical unemployment during the state of emergency. Other companies have faced freezing, but also project delays, but so far the management has not resorted to staff reductions.

The COVID-19 pandemic has changed the way we work, making remote work a more popular option among employees around the world. In addition, the combination of work and travel is now a growing trend, with many looking for jobs away from home. And Romania, with its fast internet and low prices, can be an excellent choice. A study by Momondo [10], focuses on the reasons that make Romania a top destination for distance work and travel.

Romania ranks third due to low living costs, good prices for car and hotel rentals, as well as low costs for long-term apartment rentals. The excellent speed of the internet and the English-speaking population were also considered advantages.

The ranking [10] analyzed 111 countries, classified according to 22 factors divided into six categories: accessibility and travel costs; local prices; security and health; remote work facilities; social life; and the weather. The state continues to help companies in the IT area with that 10% tax exemption, in addition it has come up with a program for the digital transformation of SMEs, not those in the area of information technology, but also included in the National Investments Plan [9].

2 Materials and Methods

As a first phase, the economic situation of Romania and Hungary will be raised from 2000 onwards in terms of GDP and unemployment. The required data were queried from The World Bank and Eurostat databases.

As a second phase, to compare open jobs, the number of job positions, available from multiple job search portals, was compared to select which job search portal data to analyze in detail. For data analysis, it is advisable to choose a portal that contains as many job announcements as possible for both Romania and Hungary. On the other hand, a query related to the analysis of job announcements can be implemented uniformly for the two countries without distorting the data queried. The following popular job search portals have been selected for preliminary comparison:

- bestjobs.eu
- ejobs.ro
- bestjobs.ro

- profession.hu
- jobinfo.hu
- LinkedIn.com

The portal with the most searchable job announcements, providing a uniform search option for Romania and Hungary, was selected for further analysis of the data.

Due to COVID-19, more and more companies are providing opportunities for remote jobs, which is also the subject of the analysis. Therefore, a job search portal has been selected, the search engine of which also provides an opportunity to search for remote jobs.

As a third phase, the number of job announcements in the selected job search portal was compared across several disciplines, but primarily for IT and Engineering jobs. The number of full-time and part-time jobs was collected during the search for which the portal provided a unified search facility for unbiased data comparison.

3 Results and Discussion

In the following, the results of the 3 phases of the research and the related conclusions are summarized.

In the first phase, the economic situations of Romania and Hungary from 2000 onwards were compared in terms of GDP and unemployment. The results are shown in Figures 1-3.

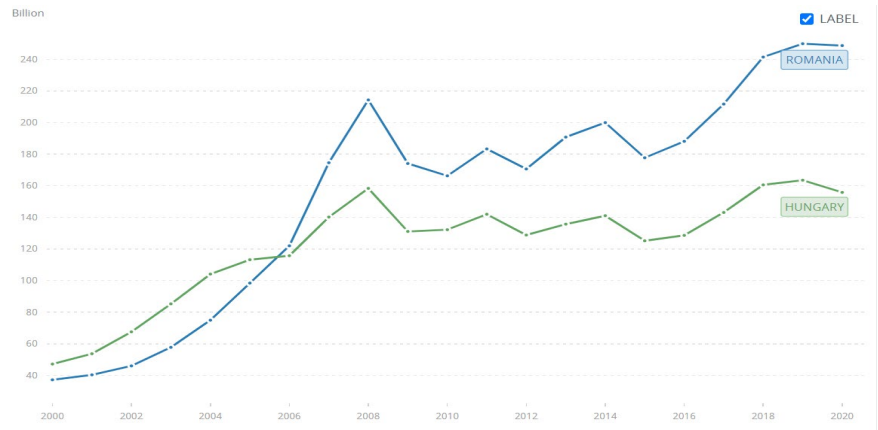

Figure 1
GDP in USD: Romania and Hungary [11]

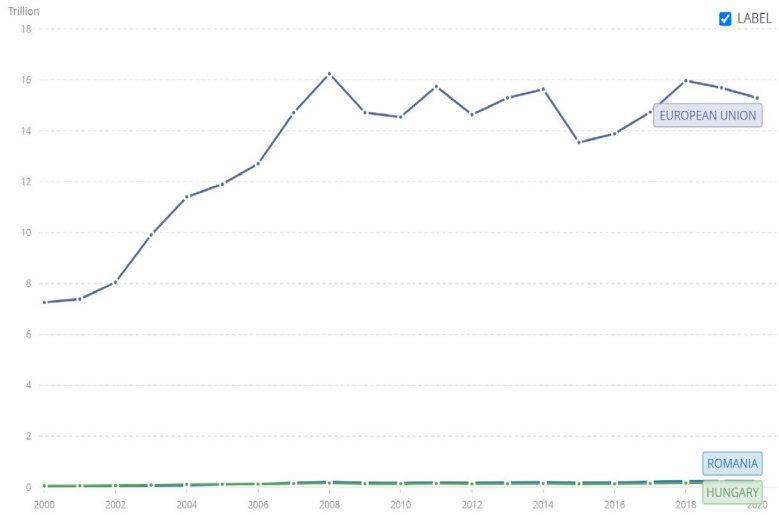

Figure 2
GDP in USD: EU [12]

The graphs show the extent to which GDP fell across Europe as a result of the post-2008 economic crisis, including, of course, Romania and Hungary. Compared to the low point in 2015, a steady increase can be observed in Romania and Hungary in 2016-2018, but in the case of the EU, GDP in 2019 is already declining. The consequences of the coronavirus epidemic were visibly negative for GDP in 2020, with declining GDP in both the EU and Romania and Hungary.

A comparison of GDP between Romania and Hungary since the 2000s shows that Romania has grown at a much higher rate, almost twice as much as in Hungary, but more than three times as much as the EU. However, Hungary's GDP growth also exceeded that of the EU. Romania was able to significantly exceed the outstanding GDP value of 2008 in the years 2018-2020, Hungary only slightly exceeded it in the years 2018 and 2019, and it was not possible to exceed the 2008 GDP value in the EU. Overall, higher GDP growth compared to the EU in Romania and Hungary also had a positive effect on the labor market, mainly in the manufacturing sector, including IT and engineering.

Figure 3 shows the unemployment rate measures the number of people actively looking for a job as a percentage of the labor force from 2016. As it can be seen in the graph, the GDP growth after 2015 also had a positive effect on the unemployment rate. Compared to the EU, Hungary and Romania also have lower unemployment rates, which is presumably due to more favorable GDP growth. Figure 3 shows the evolution of the unemployment rate for the EU, Romania and Hungary since the beginning of 2016. Unemployment is falling both in the EU and in Romania and Hungary. However, the negative effects of COVID-19 are well reflected in 2020 I and II, the rise in the unemployment rate in the third quarter.

However, it is encouraging that from 2021 onwards, unemployment has started to fall again, meaning that there is currently a growing demand for labor in the labor market.

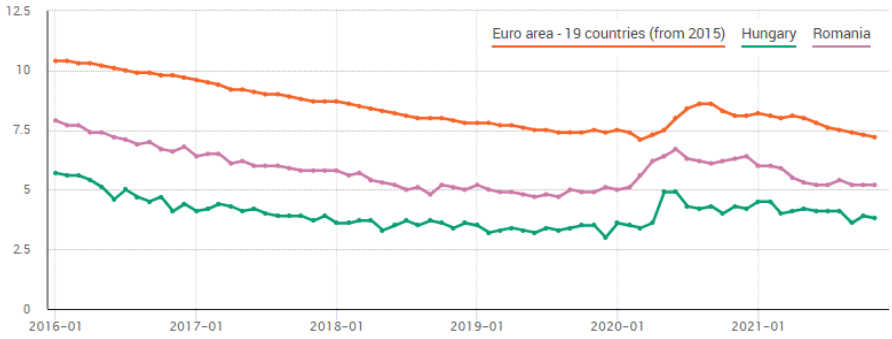

Figure 3

Unemployment rate (%): Romania, Hungary and EU (Source of data: Eurostat)

Overall, the current and expected future situation will have a positive impact on labor market developments. Based on this, it is worth examining which job opportunities are available, taking into account the number of open jobs.

In the second phase of the research, the number of job opportunities offered by popular job posting portals, was reviewed. The results are summarized in Table 1.

Table 1

Total jobs in Romania/Hungary

Portals / Jobs	bestjobs.eu	ejobs.ro	bestjobs.ro	profession.hu	jobinfo.hu	LinkedIn.com
IT / Telecom	304	3919	975	900	2084	11687
IT / Software	119	2130	459	1234	1119	14629
Engineer	57	2265	820	1762	2385	8572
Skilled worker	21	2379	891	6118	6324	1496
HR	42	776	312	691	668	970
Admin. and Secretarial	22	5257	297	1489	2642	1771

Based on the data, it is clear that the LinkedIn portal is the most popular in terms of the number of open job announcements. LinkedIn is one of the largest professional networks on the Internet. LinkedIn can be used to find the right job or internship, search and strengthen professional relationships, and to learn the skills needed to succeed in a professional career. A complete LinkedIn Profile helps to find opportunities by presenting your unique professional story through experience, skills and education.

In order to draw further correct conclusions regarding open job announcements, it is worth comparing that the use of the LinkedIn portal is equally popular in Romania and Hungary. The data in Table 2 can provide an answer to this.

Table 2
Total jobs in Romania and Hungary

LinkedIn jobs	Romani apiece	Romania piece/population	Hungary piece	Hungary piece/population
IT Services and IT Consulting	14516	0.76	6433	0.67
Software Development	10992	0.58	3655	0.38
Telecommunications	1466	0.08	801	0.08
Appliances, Electrical, and Electronics Manufacturing	1372	0.07	1829	0.19
Motor Vehicle Manufacturing	2562	0.13	1535	0.16
Human resources services	1796	0.09	1177	0.12
Internet Publishing	3106	0.16	848	0.09
Financial Services	4854	0.26	2768	0.29
Marketing services	951	0.05	522	0.05
Total	**28 046**	**1.47‰**	**15 451**	**1.6‰**

Romania population: 19034669, Hungary population: 9621547, population rate=1.98

As can be seen in Table 2, the total number of open job announcements and relation to the population also were compared for different fields. Some jobs appear in more than one category, so the sum of the numbers in each field is more than the total number of open jobs. In terms of the number of total open jobs, the use of the LinkedIn portal is similarly popular in Romania and Hungary. In Romania, the number of open job announcements is 1.47 per thousand, while in Hungary it is only slightly higher, 1.6 per thousand compared to the population, that is, the LinkedIn open job announcement portal is only 9% more popular in Hungary than in Romania so it can be used as a basis for comparison.

3.1 Jobs based on LinkedIn

In the third phase of the research the number of open jobs are analyzed, based on the database of the LinkedIn portal. So, the following is a comparison of the number of open job positions on the LinkedIn portal for Romania and Hungary. Considering the population ratio 1.98, the population of Romania is almost twice that of Hungary. The number of job announcements in Romania should be determined by normalizing to the Hungarian population (divided by 1.98), so the number of open job announcements is comparable for the two countries. The results for specified sectors can be seen in Table 3 for full-time jobs and Table 4, for part-time jobs.

Table 3
Full-time jobs in Romania and Hungary

	Romania (normalized)			Hungary		
Jobs	**On-site**	**Remote**	**Hybrid**	**On-site**	**Remote**	**Hybrid**
IT Services and IT Consulting	4310	1203	473	4107	520	436
Software Development	3620	646	234	2101	408	185
Telecommunications	528	46	34	525	74	26
Appliances, Electrical, and Electronics Manufacturing	518	22	20	1493	52	30
Motor Vehicle Manufacturing	675	61	111	1103	36	125
Human resources	621	38	32	735	24	35
Internet Publishing	764	430	53	345	251	34
Financial Services	1624	131	143	1883	58	125
Marketing	257	45	32	329	25	28
Total	**6332**	**1635**	**824**	**6658**	**933**	**820**

Romania (normalized): numbers divided by population rate 1.98 and rounded

Table 4
Part-time jobs in Romania and Hungary

	Romania (normalized)			Hungary		
Jobs	**On-site**	**Remote**	**Hybrid**	**On-site**	**Remote**	**Hybrid**
IT Services and IT Consulting	28	12	0	66	45	2
Software Development	24	1	0	24	1	1
Telecommunications	1	0	0	28	1	0
Appliances, Electrical and Electronics Mfg.	9	0	0	17	0	0
Motor Vehicle Mfg.	16	0	0	25	0	0
Human resources	5	1	0	1	1	0

Internet Publishing	1	10	0	5	3	1
Financial Services	15	1	1	7	0	2
Marketing	3	2	0	3	3	0
Total	**100**	**26**	**1**	**176**	**54**	**6**

Romania (normalized): numbers divided by population rate 1.98 and rounded

The total number of full-time job opportunities is 4.5% higher in Romania and the remote full-time jobs are 75% higher. Some jobs may appear in more than one category, so the sum of the numbers in each field is more than the total number of open jobs.

The total numbers of IT Services and IT Consulting full-time jobs are 18% more in Romania but the remote jobs are 131%, hybrid 8% more. There are much more, 67% more Software Development jobs in Romania. Software Development jobs are 72% more for one-site, 58% more for remote and 26% more for hybrid than Hungary. This means that the number of job announcements in the IT field is relatively higher than the number of job announcements in Hungary. IT Services and IT Consulting full-time remote and hybrid jobs are 28% in Romania and 23% in Hungary relative to total. But these values for total Software Development jobs are 19% for Romania and 28% for Hungary. Employers in Romania and Hungary are also open to remote work in the IT sector.

There are slightly more job opportunities in Hungary, in the Telecommunications sector, in this case there are more opportunities for remote work in Hungary.

There are much more job opportunities in Hungary in the Appliances, Electrical, and Electronics Manufacturing sector. The total number of jobs is 181% more in Hungary than Romania, remote and hybrid work are similar.

The open positions in Motor Vehicle Manufacturing is more in Hungary, than in Romania, with 49%, but there are more remote work opportunities in Romania, while the hybrid is a little bit higher in Hungary.

The number of part-time job open positions is negligible compared to full-time job opportunities. The part-time jobs are 74% higher in Hungary. Hungary has much more Telecommunications and IT Services and IT Consulting open part-time jobs.

3.2 IT Software Jobs based on LinkedIn

The open IT software jobs are summarized in Table 5 for full-time jobs and Table 6 for part-time jobs.

The total number of full-time IT job opportunities is 59% higher in Romania and the remote full-time jobs are 98% higher. Some jobs may appear in more than one category, so the sum of the numbers in each field is more than the total number of open jobs. It can be seen from the table that in all respects there are significantly more open IT software jobs in Romania than in Hungary. From this it can be

concluded that Romanian companies want to develop very much in the field of software, and they may have significant market opportunities in this field.

Table 5
Full-time IT software jobs in Romania and Hungary

	Romania (normalized)			Hungary		
IT jobs	**On-site**	**Remote**	**Hybrid**	**On-site**	**Remote**	**Hybrid**
Software Engineer	3621	646	234	2101	408	185
Senior Software Engineer	317	200	52	263	88	48
Java Software Engineer	242	143	55	175	51	51
Javascript Developer	246	175	52	174	65	64
Back End Developer	312	226	71	223	82	66
DevOps Engineer	231	138	51	169	59	33
Full Stack Engineer	582	317	112	451	180	119
Total	**5552**	**1847**	**628**	**3556**	**933**	**566**

Romania (normalized): numbers divided by population rate 1.98 and rounded

Table 6
Part-time IT jobs in Romania and Hungary

	Romania			Hungary		
IT jobs	**On-site**	**Remote**	**Hybrid**	**On-site**	**Remote**	**Hybrid**
Software Engineer	8	2	0	16	4	2
Senior Software Engineer	1	1	0	1	0	0
Java Software Engineer	0	1	0	0	2	0
Javascript Developer	0	1	0	0	1	0
Back End Developer	0	1	0	0	3	0
DevOps Engineer	0	0	0	0	0	0
Full Stack Engineer	0	1	0	2	2	0
Total	**9**	**5**	**0**	**19**	**12**	**2**

Romania (normalized): numbers divided by population rate 1.98 and rounded

The number of part-time job open positions is negligible compared to full-time job opportunities. The part-time IT software jobs are 121% higher in Hungary. Hungary has many more Software Engineer part-time open IT software jobs.

4 New Perspectives and Observations

Looking more broadly, there are regional distinctions to consider when comparing these two nations. Public funding and infrastructure improvements can have a profound effect on economic growth and job markets. This is where distinct variations between Romania and Hungary come into play, necessitating a closer examination. While economic metrics are relevant, demographics also play a significant role in shaping a labor market. A younger population may have more leeway and adaptability, which can be valuable, in rapidly evolving domains, such as Information Technology.

Teleworking is becoming increasingly popular in both Romania and Hungary, but disparities in company culture and attitudes may affect this trend. Our investigation into job opportunities using LinkedIn revealed a considerable gap in IT and engineering positions between the two countries, attributed to technological advancements and local markets. Interestingly, the demand for IT and engineering sectors is greater in Romania, while Hungary demonstrates a more flexible approach to teleworking and part-time positions, which could explain sector-specific differences. With the rise of the "gig economy", there's a possibility that the current negligible number of part-time positions in comparison to full-time ones may become a thing of the past. Such conjecture is fueled by data indicating a shift in this dynamic down the line.

Job-specific differences can also have an impact on education and training. In Romania, it may be worth strengthening IT training, and in Hungary, electrical and electronics engineering programs. In both countries, such a development could help fill higher value-added jobs. The positive correlation between the labor market and economic growth suggests that the development of coordinated economic policy and education strategies would be ideal for sustainable development.

Conclusions

The benefits of digitization are obvious, but there are also risks. Human resources specialists, together with the company's management, must redesign their strategy, roles, activities, and structure so that employees do not feel the absence of direct interaction and ensure a work environment and an organizational culture based on sound values and principles. In addition, due to the rapid development and change in the field of programming, it is necessary to select the most suitable technology for the development teams in order to achieve the most efficient, effective and long-term development possible [15] [16].

Employers also need to implement clearly defined internal systems, procedures, and internal policies regarding remote work to prevent legal or organizational discrepancies in the work schedule of employees.

Many new subfields of software engineering have been identified in the process of research and data collection, such as: business process automation, data analytics,

machine learning, cloud engineering, which involves in addition to knowing a programming language, many of other tools, frameworks and platforms, for the candidate to meet the requirements of the job offered.

In conclusion, the future of Human Resources (HR), will be shaped by digital transformation and, given the changing structure of the workforce, digitization and automation are becoming key components in managing labor relations. But to ensure full success, in this regard, it is equally important that human resources and pay specialists receive training and support from decision-makers in implementing the necessary changes. The work team of a department, or organizations, depends on the work of the human resources team. The effort made in several directions of promotion and advertising can bring medium- and long-term benefits for companies.

The digital transformation and the development of labor market competences in higher education is not only the responsibility of educational institutions, but also requires alignment with current industry trends and future projections. Just as human resources and corporate management are increasingly relying on digital tools and strategies to engage employees and manage teleworking, so too educational institutions need to adopt a multidisciplinary approach [17]. This includes technological adaptation, developing people-centered skills and understanding legal and organizational frameworks. The aim is that students are not only professionally prepared, but also equipped with a complex set of skills, to meet the dynamically changing needs, of the new and evolving labor market.

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