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# Job offer on the Romanian labor market in digital economy

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## ABSTRACT

*The Fourth Industrial Revolution had a major impact on the labor market. There are many consequences of the digitalization of the economy, but this research shows the changes in supply structure on the Romanian labor market. The companies that are operating in Romania usually publish job opportunities on recruitment platforms. Using the web scraping techniques we will identify which jobs are currently available on the Romanian labor market, in which cities, but also the field of activity. First of all, we will analyze the concentration of jobs in cities. We will classify these jobs based on an official classification code used by the Romanian state, because the job offer is very wide. Moreover, we will analyze the level of experience and the level of training that the candidate must have.*

*In Romania, the main economic centers are Bucharest, Timisoara and Cluj-Napoca. In these three cities we also identify the highest concentration of jobs. There are many jobs in the IT field and those jobs that involve communication. Candidates with at least one year of experience in the field are preferred, as well as candidates who are willing to work full time. It can be noted that jobs with repetitive activity have almost disappeared, because they have been replaced by industrial robots. Also, it can be seen that employers are looking for candidates with higher education. In this step we will talk about job polarization phenomenon.*

*Finally, the paper aims to indicate the stage of development of the Romanian labor market and what young people need to know before choosing their future career. Also, this paper is the starting point of a wide research about digitalization on labor market.*

**Keywords:** *job offer, online platforms, digital economy, text mining, text processing, web scrapping, job polarization*

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## 1. INTRODUCTION

Today's society is facing the Fourth Industrial Revolution, which is based on the automation of industrial processes and on the use of hardware equipment to control them and an unprecedented development of artificial intelligence. As a result, all industries need to adapt in order to survive. The digitalisation of the economy has a major impact on the labor market, especially in less developed countries. Moreover, one of the effects of the digitalization of the economy on the supply of jobs is their polarization.

The topic addressed in the research will focus on the supply of jobs on the Romanian labor market and whether the polarization effect determined by the digital economy is observed. First of all, the specialized literature will be presented, in order to describe the implications that the digitalization of the economy has on the supply on the labor market. This section is followed by a presentation of the changes that have occurred in the job offer over the years in Romania. More specifically, the evolution of the job offer for the main groups of occupations (according to the Code of Classifications of Occupations in Romania) in recent years will be highlighted, based on the official reports of the National Institute of Statistics. In addition to the above, the jobs currently available on online recruitment platforms will be analyzed. The main groups of occupations of interest for companies, the level of training required of the candidates, but also the main skills and knowledge that the candidate must have will be presented. Finally, the development stage of the Romanian labor market and what young people need to know before choosing their future career will be presented.

## 2. LITERATURE REVIEW

Even though the phenomenon of digitization has been going on for decades, the development of Big Data and robotics heralds a new economy (Degryse, 2016). The impact of digitalisation on the labor market has become a rather controversial topic and has been discussed for the last 30 years. This is largely due to the complexity of the relationship between digitization and jobs (Valenduc & Vendramin, 2016). The development of technology is seen as an important factor in increasing the number of unemployed, both in Romania and in Western countries. The changes in the labor market caused by digitalisation are not necessarily negative. Like any invention, the discoveries in technology have as their main purpose the evolution of society. The automation of some processes will determine the disappearance of some jobs, but also the appearance of others. This aspect can rather be considered a structural change

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in employment according to industry, occupation, qualification and tasks (Ulrich, 2016). However, the risk of automating certain jobs depends very much on the cost of developing the solution, the dynamics of the economy and the economic benefit of this solution (Heald, Smith, & Fouarge, 2019).

Companies active in the market that have had investments in the direction of digitalization have started to reconfigure their business model trying to stay competitive. With this reconfiguration comes the need for specialized employees. Thus, the labor market supply focuses rather on jobs that require a high and low qualification, which do not involve repetitive activities. This trend has been called “job polarization”. This phenomenon means an increase in the employment rate of well-paid specialists and managers, but also of low-paid workers in services and a reduction in the demand for workers in the manufacturing industry and employees performing repetitive activities (Goos, Manning, & Salomons, 2014).

In April 2020, a study was published analyzing the polarization phenomenon in Central and Eastern Europe (CEE). The conclusions of the study confirm the hypothesis that the demand for jobs that require an average level of training decreased by about 9 percentage points in 2016, compared to 2000. Moreover, research shows that specialists are the most sought after in the labor market work in the CEE, identifying an increase of about 69% in 2016, compared to the year 2000 (Nchor & Rozmahel, 2020).

Regarding the skills of Romanians, the European Center for the Development of Vocational Training has built an index that measures the performance of skills systems at European level. In this research, Romania was ranked in the group of countries with poor results. Romania has the weakest performance in skills development due to lack of access to technology and training. The most undesirable aspect is that 15-year-old students fail to get good scores in terms of reading, applying mathematics or science knowledge. Romania also occupies a low position in the number of graduates who managed to get hired. There is also a relatively positive aspect, namely the matching of skills with the requirements of the job (European Centre for the Development of Vocational Training, 2020).

Moreover, the European Center for the Development of Vocational Training also analyzed the job offer published online in Romania during 2018-2019. The study shows that 47.4% of jobs require employees the ability to adapt to change, while the use of communication techniques is the least common ability (European Centre for the Development of Vocational Training, 2020).

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### 3. METHODOLOGY

The proposed case study refers to the analysis of jobs published on recruitment platforms in Romania. In this approach, the following steps will be completed: data description, data processing and subsequently data analysis.

The data used in the case study were obtained through the web scraping technique from an online recruitment platform widely used in Romania. Basically I built a recursive script in Rstudio that extracts certain objects from the HTML page. This automatic data extraction technique is possible due to the HTML language used to create web pages and which is a structured language (Landers, Cavanaugh, Brusso, & Collmus, 2016). Thus, in October of this year on this online platform were active about 2400 jobs and trainings published by companies operating in our country. From the web pages of the platform we selected the name of the offered position, the field of activity, the location, the required level of experience, the availability necessary for this job, but also the description of the offered position. The jobs published on these recruitment platforms do not detail all the requirements that the future candidate must meet. Moreover, many of the jobs do not actually present the activity or requirements, but the company that offers the job. Because of this, it was necessary to map jobs based on the Romanian Occupational Classifications Code.

In the data processing stage we removed punctuation marks, special characters, numbers and connecting English words from job descriptions. Then we applied tokenization method, which means dividing sentences into words. After that, the words are lemmatized. Lemmatization method means transforming words into basic form. The processed corpus will be transformed into the Term Document Matrix. This matrix will be used to apply text mining methods.

The analysis of texts written in natural language can be considered a machine learning technique. It is not a fixed method, it can be customized depending on the topic approached and the answers you want to get. Text analysis starts from calculating frequencies, classification, recognition of entities, identification of topics, sentiment analysis and many other derivatives.

In the case study I will analyze an unstructured data collection using Topic Modeling, a text mining technique that establishes semantic patterns. This statistical method is a form of unsupervised classification. The natural language processing method is known as Latent Dirichlet Allocation or LDA. The mathematical model is based on two major principles. Each data collection contains a variety of topics covered and in turn these topics are composed of several words of specific importance. Basically, the Latent Dirichlet Allocation

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method in this case will identify the collection of words that define a group of characteristics, while determining the characteristic groups that define the entire job base.

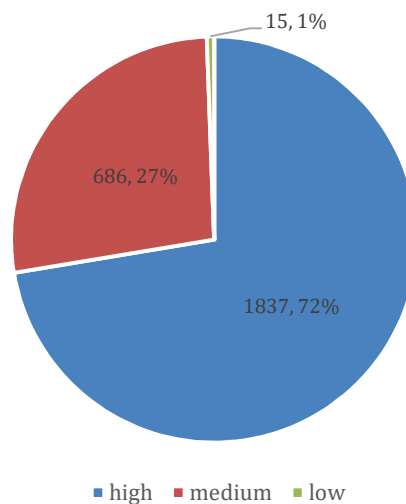
The whole process of data collection, data processing and data analysis was done with the help of RStudio software. For data collection we used functions of rvest, plyr, xml2 packages. In the data processing stage we used functions from the tidyverse and tm packages offered by Rstudio. In the data analysis stage we used both the topicmodels package and other packages designed to obtain graphics, such as wordcloud and shiny. Additionally, we used simple graphs built in Microsoft Office Excel.

#### 4. RESULTS AND DISCUSSION

According to the National Institute of Statistics, the number of vacancies increased considerably between 2012-2019. The year 2020 is more affected in this respect, due to the global pandemic and the crisis it has caused in the economy. The results show that the supply of active jobs available on the market in October indicates a higher demand for jobs that involve higher training.

**Job distribution by level of studies**

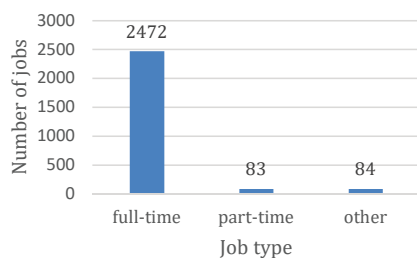
*Figure no. 1*



*Source: Generated by author in Microsoft Excel and using data from online platform*

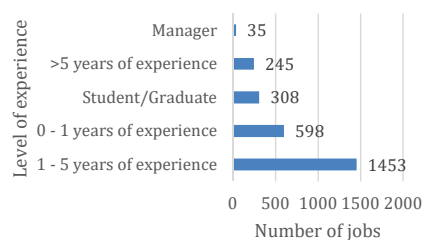
From the 2,538 positions, approximately 72% correspond to a candidate profile with higher education, 27% of the jobs are for people with secondary education, and the remaining 1% are jobs that require low-level education. Employers want the most specialists in various fields of activity in proportion of approximately 66%, but also technicians and other specialists in the technical field in proportion of 16%. Administrative officials, service workers, skilled and assimilated workers, operators of installations and machines, assemblers of machines and equipment, but also elementary occupations reach a percentage of 12% of the total jobs posted.

**Job distribution by job type**  
*Figure no. 2*



Source: Generated by author in Microsoft Excel and using data from online platform

**Job distribution by level of experience**  
*Figure no. 3*



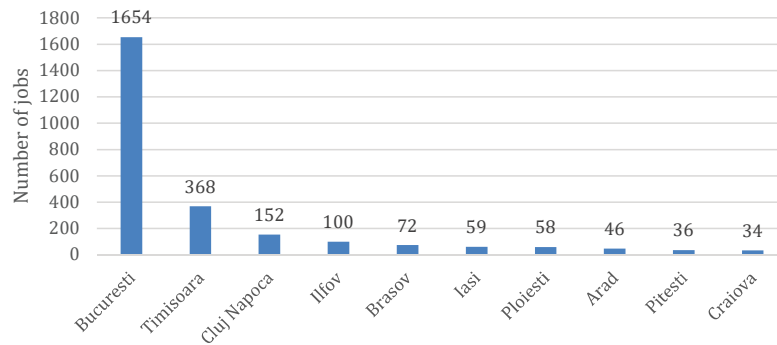
Source: Generated by author in Microsoft Excel and using data from online platform

In terms of the type of job, the largest offer is for people who are willing to work full time and for those who have a level of experience at least 1 year in the field.

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### Job distribution in top 10 Romanian locations

Figure no. 4



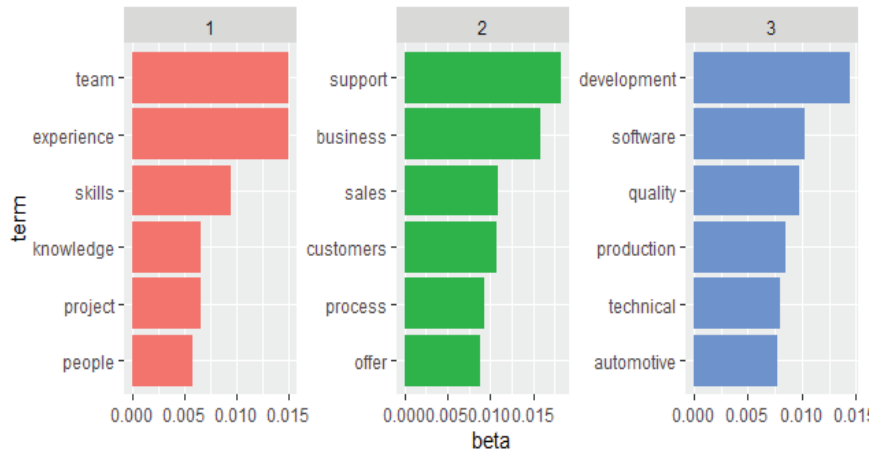
Source: Generated by author in Microsoft Excel and using data from online platform

A very important aspect to mention is the country-wide distribution of these jobs. It seems that the jobs offered by employers on online recruitment platforms are mainly from the big economic centers in Romania. This is normal, as digitization is not widespread in all regions of the country.

In addition to the quantitative aspects extracted immediately from the database, from the processing of the job descriptions, we extracted the main topics addressed in them. There are jobs for which there is no description, which is why they have been excluded in order to obtain reasonable and relevant results. A fairly important parameter in the Latent Dirichlet Allocation model is the beta parameter, which helps to rank words within topics. Often, due to the texts used, the results are more or less strong.

### Three topics discovered and its keywords

Figure no. 5



Source: Generated by author in RStudio and using data from online platform

We considered of interest three topics that we renamed according to their scope: experience, soft skills and technical skills. The model assigns to each record the list of the three topics, but also a gamma parameter, which helps us decide which topic is right for the description of that job. Thus, 49% of the jobs require some work experience in the field, for 28% of the jobs soft skills are important, and for 24% of the jobs analyzed the technical skills are a priority.

Latent Dirichlet Allocation, however, did not highlight the topics as desired, which is why we completed the analysis with a simple analysis to extract some patterns from the data indicating exactly what was observed in the previous method, but not as clearly.



## Soft and technical skills

Table no. 1

Soft skills	%Rate	Technical skills	%Rate
Relevant experience	55,92	Programing software	23,82
Foreign languages	41,27	Microsoft office	18,09
Communication skills	35,16	Accounting	21,91
Team work	14,52	Data science	12,23
Analytical	13,50		
Problem solving	11,08		
Motivation	8,66		
Creativity	7,64		
Negotiation skills	3,18		
Time management	1,91		
Adaptability	1,53		
Interpersonal skills	0,76		
Open mind	0,76		

Source: Generated by author in Microsoft Excel and using data from online platform

The results obtained from the analysis of the data obtained for a short time window are somewhat similar to the analysis developed by the European Center for the Development of Vocational Training, which identifies as essential skills those specified above.

## The most common skills required

Figure no. 6



Source: Generated by author in RStudio and using data from online platform

It can be seen that in general, the jobs on the recruitment platforms want the future candidates to have very well defined so-called soft skills. Obviously, the technical knowledge is not left to chance, but they are better

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focused in terms of jobs dedicated to specialists. As a result of the digitization and automation of repetitive processes, the skills that these routine jobs required are no longer needed. It is very important for employers to ask candidates for skills that will train their thinking and communication skills. Candidates must be able to make decisions in certain new situations. The digital age is actually about the ability of people to create, to imagine solutions or how technology could help them in their workplace. Obviously, it is important that employees also have technical skills related to technology, because many activities become easier.

It is known that large corporations want to produce more and become more profitable, so they invest in technology and people who know how to cope in such an environment. In fact, jobs are not disappearing, but structurally changing.

Some employees do not adapt, which is why unemployment occurs. There are also employees who have speculated on the benefits of the changes and that their work has become easier.

It is not enough for only companies to want this change, but also for the state. Usually, if a company does not have enough human capital adapted to the new needs of the company, it decides to leave that country. The human resource adapted to the new economic era must be prepared through an updated educational system. This approach is quite complicated in Romania, because in some regions of the country students do not have access to the minimum education. It is true that these shortcomings cannot be radically changed, because they depend on many economic and social factors about which I do not have much information. It can also start with a closer collaboration between state bodies and companies operating on the Romanian market. There are companies that see a good potential in the Romanian human resource and are unconditionally involved, but there is also the option for the state to offer facilities to companies to intervene in the university training process and not only.

As we have noticed, specialists are the main attraction on the Romanian labor market. Most of the jobs extracted from the database are in the field of IT Hardware and IT Software. As a result, it is interesting to analyze which are the most wanted features, as they would have more homogeneity in terminology and would lead to a more consistent analysis



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because artificial intelligence has become so advanced that it will write its own code, but it is necessary for a specialist to take care of maintenance or change direction when necessary.

The main skills identified in IT jobs are both soft skills (relevant experience-25.44%, communication skills -12.63%, foreign languages -10.53%, problem solving -8.25%, creativity-7.54%, motivation-6.49%, team work-4.04%, analytical thinking-2.63%, adaptability-0.35%) and technical skills. Technical skills mean both programming languages (C++ -5.79%, cloud-5.09%, java-3.86%, R -3.16%, .NET-1.58%, Angular-1.58%, Python-1.58%, Amazon web services-0.88%, CSS-0.53%, ETL-0.35%, MatLab-0.35%, Network protocols-0.35%, Perl-0.35%, Ruby-0.35%, Cobol-0.18%, Firewall-0.18%, Kafka-0.18%, Linux-0.18%, Scala-0.18%, Wide Area Network-0.18%, Hadoop-0.18%), programming concepts (Scalable programming-1.05%, Object Oriented Programming -0.7%, Optimization-0.7%, ) and databases (SQL/NoSQL -3.8%), as well as theoretical and practical knowledge in the area of data science (Computer science -4.21%, Big Data-0.7%, Forecasting-0.35%, Clasification-0.18%, Machine Learning-0.18%, Regression-0.18%, Data visualization-0.18%).

Previously, we presented the most known and most wanted soft skills, technologies, programming languages and technical knowledge that IT specialists need to understand and know. Obviously, there are many technologies to which reference is made, but these are the most appreciated and with a fairly wide spectrum of use in any field of activity.

## 5. CONCLUSION

The labor market in Romania, referring to the supply of jobs on online platforms indicates a strong polarization. This aspect confirms that the European trend demonstrated by other researchers is also maintained in Romania. There is a predominant requirement for specialists and less for mid-level employees. The shortcoming of online platforms in Romania is that there are no restrictions when the employer submits the job. Most of the time, instead of the description, nothing is found or a general description of the company is found, which is not exactly right. Because of this, although the number of jobs is reasonable, textual modeling is not very effective, as texts are often lacking in information. In the current epidemiological context, these platforms are very useful, but the candidate loses a lot of time only to identify if that job is suitable for his training. As time is one of the most important resources, a more detailed specification of the main requirements and benefits that the company has would exponentially reduce the recruitment process.

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However, the information provided was sufficient to outline the job offer on the Romanian market. One of the most important strengths required by employers is experience, but often young people do not have this experience. Therefore, recruitment companies periodically organize various events, trainings, workshops, to which top companies operating on the market are invited. Thus, young people have the opportunity to try new things and much closer to what employers want. Moreover, it is important that when young people choose a field of study to focus on the three aspects described above: experiences, soft skills and technical skills. They certainly cannot decide for themselves which direction they should go, but here a career counseling organized by the educational institutions themselves should intervene.

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