
Evolution of the Labor Market and Competency Requirements in Industry 4.0 versus the Covid-19 Pandemic

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Abstract:

Purpose: In the run-up to the disruptions to the economic closure due to the dangers of a global pandemic, the labor market situation developed to the benefit of jobseekers. Thus, 2019 was assessed as the employee market. However, changes in the labor market take place in real time and, as it turns out, meeting them is not only difficult due to the reaction time, but above all due to their intensity. The aim of the article is to present changes in the labor market caused by the SARS-CoV-2 virus pandemic in relation to the evolution of individual sectors towards economy 4.0.

Design/Methodology/Approach: To achieve the main goal of the article, theoretical literature review was chosen, in particular argumentative review, which could introduce problems, but certainly constitute the introduction to in-depth research, also empirical.

Findings: The article consists of 3 parts. In the first of them, the theoretical definition of the category of competences was made - which is an introduction to considerations of a utilitarian nature. The second part defines what types of competences accompanied the classical labor market. The third part focuses on identifying possible directions of employee competency development, including defining the range of necessary competences resulting from a) the need to adapt to market changes as a result of the pandemic, and b) the evolution of individual sectors towards the 4.0 economy.

Practical Implications: They focus on highlighting significant changes that have already begun in the labor market, and the consequences of which will be long-term. These changes relate to the competency requirements of employees of various industries, and thus the phasing out of those sectors of activity that will no longer be crucial for civilization in the future. The forecasts contained in the study are speculative, but nevertheless result from the observation of historical and contemporary changes, in terms of organizations and world economies.

Originality/value: In the article we propose an original set of competencies, which are crucial for the emerging new professions that respond to Industry 4.0 and which have been catalyzed by the global SARS-CoV-2 pandemic.

Keywords: Professional competences, economy 4.0, Covid-19 pandemic, labor market.

JEL classification: J20, J21, J23, J24, L22, M12.

Paper Type: Research study.

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1. Introduction

The disruptions caused by the Covid-19 pandemic intensely remodeled the existing dependencies on the labor market and shook the long-term positive financial results of enterprises (Grima *et al.*, 2020; Khan *et al.*, 2020). Even before the pandemic, the labor market in Poland was referred to as the employee's market. It was manifested in a situation where employers had problems with recruiting and finding suitable candidates for work in their companies. It was a good situation for employees to look for new opportunities, who could choose offers according to his opinions and criteria and negotiate his conditions to take a specific job. Compared to 2019 (in which Poland had the lowest unemployment level in 30 years), 2020 was dramatic. The unemployment rate in Poland at the end of September 2020 was 6.1% (Registered unemployment I-III quarter 2020), and further forecasts are not optimistic. By analyzing various scenarios for the development of the environment of the contemporary organizations, one solution emerges that may become an opportunity for those employees who have lost their jobs - perhaps permanently. This solution is new opportunities related to the dynamic development of Industry 4.0. Those solutions certainly require time, but the remodeling of the global economy is already a fact. Unfortunately, the impact of the fourth transformation of the economy has not yet been studied in detail in management sciences (Niemczyk *et al.*, 2019). Therefore, our considerations can be viewed as speculations, although the conclusions are highly utilitarian.

In 2011, a new economic model appeared, described as the Industrie 4.0, which was recognized as a key element of the innovative development strategy (Mariani and Borghi, 2019). According to the inventors, it was to use automation and digitization processes to transform existing enterprises into self-steering and self-adapting social engineering systems that would allow the creation of intelligent value chains (Herman *et al.*, 2016). The effect of such changes was to be a rapid increase in the efficiency of enterprises and the creation of new business models, services and products, which was to contribute to a specific share of German industry in the global economy (Kagermann *et al.*, 2013; Mariani and Borghi, 2019). "Industrie 4.0 Working Group" highlights the three basic areas which build the Industrie 4.0, which are cyber physical systems (Cos), Internet of things (IoTS), and smart factories (Kagermann *et al.*, 2013). There is a specific synergy effect between these elements, which determines not only changes within modern organizations, but also changes in their ecosystems - which seems to be a natural consequence of such advanced organizational changes.

In such conditions, has the Sars-COV 2 virus pandemic become an additional catalyst accelerating changes in the current economy, and thus in the labor market and the competency requirements of potential employees? What are the current expectations and requirements of employers and what competencies are they looking for in candidates for specific positions? Which professions gained during the

pandemic by adapting to new conditions and which ones lost when the pandemic and the industrial revolution 4.0 turned out to be the determinant of changes?

The aim of this study is to verify the thesis that traditional professional competences (i.e., the behaviors, abilities and skills of an employee before the period of rapid changes caused by a pandemic and virtualization of manufacturing processes) are different in relation to those expected from an employee in the 4.0 economy. In our view, the disruptions caused by the pandemic have only accelerated this process. To this end, the first part reviews professional competences in the literature and presents the situation of the labor market in Poland before March 2020. The second part defines what types of competences accompanied the classical labor market. The third part focuses on identifying possible directions of employee competency development, including defining the range of necessary competences resulting from: a) the need to adapt to market changes as a result of the pandemic, and b) the evolution of individual sectors towards the 4.0 economy.

2. Conceptualization of the Category of "Competences"

In literature, competences are often associated with knowledge, and as knowledge occurs in the form of three sets, namely the knowledge and skills of: a) employees, b) contained in technological and management systems, and c) knowledge being a set of values and norms in which this knowledge is kept (Rokita, 2005). The classic approach of R.L. Katz identifies three main competences (abilities), namely strictly specialized (technical), conceptual and interpersonal (Witkowski, 2004), which are revealed in action and may be acquired - not innate in nature. Technical skills consist in knowledge of the procedures for performing specific professional activities, and the degree of professionalism is determined by the degree of combining technical and interpersonal skills.

The primary task of a manager is effective communication with all management levels, therefore he should be able to cooperate with internal and external clients. Interpersonal skills include everything that facilitates dealing with people, i.e. effective communication, evaluation, motivating, etc. Conceptual skills are expressed according to R.L. Katz in perceiving individual institutions as a whole, in seeing the relationship between individual activities, between the organization and its turbulent environment. According to this author, these are the most important skills, determining the quality of decisions made, they constitute the basis for coordinating the work of an organization by directing employees towards a common goal. This classic approach is the basis for other classifications of competences found in literature (Śniadecki and Nogalski, 1998), which identified as organizational, conceptual, administrative, technical and also interpersonal.

However, many researchers in this context share the view that professional competences should be considered in relation to the personality of the employee. It should be remembered that competences are difficult to measure due to their

qualitative nature (Balcerzyk, 2017). Thus, in the British and Scandinavian models, the dominant view is that the professional competences of employees should be considered irrespective of permanent personality structures. There are no such elements as mental predispositions or personality traits in the set of competences in these schools. This approach is also proposed by Thierry, Sauret and Monod (1994) who claim that competences are the totality of knowledge, abilities to act and attitudes depending on the goals and conditions of action. A slightly different approach in this system is proposed by the American school, where the dominant approach has become person orientation, the purpose of which is to identify those features that allow to distinguish people with above-average results from others. Thus, competencies in this approach include skills, personal characteristics and behavior. The ability to build trust deserves special attention in the field of social, interpersonal competencies (Balcerzyk, 2020).

Moreover, we can still find this understanding of the concept of competence according to L. Spencer and S. Spencer (1993), who illustrated it by creating a four-level model of an iceberg. At the top of the iceberg is knowledge, below skills, even lower ethical values / standards of behavior and at the bottom are individual predispositions, i.e. motives that encourage action, enthusiasm, openness, imagination, assertiveness, leadership skills, tact, diplomacy, optimism and self-image.

Armstrong (2007) noted, however, that there are two terms related to the concept of competence. In a broader sense, focused on a person as an individual, he considered that the person is competent when they have the appropriate predispositions to behave and act skillfully. Next, it presents competence in the meaning of the requirements necessary to perform tasks in individual areas of work. Nevertheless, the conceptual views emphasize two main elements building the competence category:

- those related to the technical side of the activities performed, knowledge and skills (Sutherland and Canwell, 2007; Oleksyn, 2014), formal powers to act, attitudes and behaviors expected in the workplace (Oleksyn, 2014), individual, expressed in the interpersonal characteristics of a given person;
- personality traits, internal motivations, criteria of self-esteem (Whiddett and Hollyforde, 2003), system of behavior (Sutherland and Canwell, 2007), as well as health and condition, abilities and predispositions, psychophysical features important from the point of view of work processes (Oleksyn, 2014).

When making a conceptual review, one should also pay attention to various categories and criteria according to which competences are presented, because there is no one perfect definition. Some researchers, such as A. Poczowski, distinguish basic and differentiating competences related to the given job, i.e. skills and knowledge, in the case of a manager it is the ability to communicate, solve

problems, using the services of advisors, professional experience and features that distinguish an effective employee from others. They include values, attitudes, motives, in the case of a manager future orientation, awareness of values, empathy, leadership, tolerance, readiness to learn (Pocztowski, 2003). There seems to be no point in making any further classifications. Indeed, what is most important in a variety of approaches to competences is that they can be classified into these two groups. An appropriate set of basic and distinctive competences determines the success of an employee on the labor market in the 4.0 economy, and from the point of view of the organization - allows it to acquire key competences. They are a collection of a variety of skills, practice and complementary resources that form the basis for a company to compete and gain advantage in a specific business (Teece *et al.*, 1994). Those arise in the process of organizational learning, and their consolidation is possible thanks to technological innovations. This process happens in such a way that the created competences become independent of their original carriers, i.e., individual employees, and the organization becomes the ultimate beneficiary.

The authors indicate that in the short term the company's competitiveness results mainly from the price and quality of the product. In the long term, it is ensured by the company's key competences, which affect the creation of new products expected by customers and better organization of the company's business activities. The real source of competitive advantage is the ability of managers to create technologies and production skills that ensure the individual strategic units of the company quickly adapt to changing conditions (Prahalad and Hamel, 1990).

According to the presented approach, the organization is an open set of resources, the elements of which are selected in a way that allows the company to achieve an appropriate market advantage. When talking about competences, it is worth noting that in the literature, this concept is not clearly perceived. Concepts that often accompany "competences" in theoretical considerations are qualifications and skills. However, qualifications and skills have a narrower context than the competences that result from having many different skills and qualifications. Competencies characterize what an organization excels in all its businesses. Skills, on the other hand, cover what the organization "does well" to a limited extent, including specific activities, e.g., in the value-added chain.

There are many definitions of the concept and they are certainly an extremely important aspect of the discussion. Nevertheless, it should be emphasized that they should meet a number of criteria, which at the same time define the features desired by the organization - depending on the market position and the industry they characterize. For this purpose, we used the VRIO J.B. Barney. Thus, competences, as well as resources, should (Barney, 1997):

- enable the creation of organizational value,
- participate in creating the uniqueness (rarity) of the enterprise,

- make the organization difficult to imitate,
- result in a high level of organization of market entities.

The implementation of such assumptions is possible thanks to their juxtaposition with dynamic abilities (Nun and Nelson, 2012). Such a set of elements gains importance in conditions of a particularly changing environment and allows for achieving new reconfiguration of resources (Eisenhardt and Martin, 2000). These conclusions lead to the following questions:

1. Does the modern education system respond to the needs of 21st century organizations?
2. Which competences can be considered crucial for the organization in the economy 4.0?

We try to answer these research questions in the paper so our attention will be focused on competences in classical and current – Industry 4.0 – area of interest.

3. Competences on the Labor Market - Classical Approach

The situation on the labor market shows that the competences of university graduates do not meet the expectations of employers and this is not much related to the pandemic. In fact, you could see it 10, 20 and 30 years ago. This is due to the fact that the needs of employers change depending on the emergence of new technologies on the market, and these are not synchronized with the study programs. It is therefore happening very quickly, as the needs of clients and the situation on the labor market change rapidly. Despite the fact that universities cooperate with their ecosystems, creating new curricula dedicated to the needs of entrepreneurs, it still does not happen in a sufficient way. These activities are flexible, which means that graduating from higher education does not prepare graduates for work. Moreover, according to the estimates of the World Economic Forum from 2016, more than 65% of children entering school will work in professions that do not exist yet. Many professions will disappear completely, others will be replaced by automation and robotization. It should also be remembered that a graduate entering the labor market will remain there for about 40 years, so vocational education must be constantly supplemented during this time. This creates great opportunities for the training market, and poses a considerable threat to universities.

When analyzing the results of research reports, in 2018 about 50% of employers indicated difficulties (e.g., lack of employees meeting professional expectations, low number of responses to job advertisements, high financial expectations in relation to the tasks performed, etc.) with finding suitable employees, and a year later, problems of this type were reported by 86% of entrepreneurs (Effective employer, 2019). Analyses and research conducted in Poland indicate that the most common reason for problems with filling vacancies is the lack of required professional and technical competences of candidates (Effective employer, 2019).

When reviewing the available research in the field of market demand for specific skills and competences, employers indicated that they were looking for (Turek, 2019):

- key competences, both in the scope of work in strategic and lower-ranking positions, but requiring specialist knowledge in a specific field;

Interestingly, the age of employees was not important for entrepreneurs - they spoke positively about thirty-year-old, forty-year-old and even sixty-year-old candidates.

- among the key competences of the employee, the so-called social skills ability to cooperate in a team, effective communication, work organization, and: diligence, reliability, responsibility, punctuality, accuracy and perceptiveness, high personal culture, honesty, initiative, humility and discipline, flexibility, willingness to learn, independence and efficiency.

Representatives of employers and heads of human resources departments, basically regardless of the industry and location of the enterprise, pointed to the dominant role of transferable competences. It is communication skills, the ability to cooperate, openness to clients and readiness to learn that guarantee that professional activities can be performed efficiently. Therefore, the importance of social and personal skills in the competency profiles of job candidates is growing.

Summarizing the proposals listed in the national and foreign literature, it is possible to propose a standard range of competences, which in the 3rd industrial evolution covered a range of competences:

1. Based, of the following nature:
 - cognitive, e.g. flexibility of thinking, broad horizons, readiness to learn, creativity,
 - social, i.e. the ability to cooperate in a team, communication between employees, work culture,
 - personal competences, i.e. conscientiousness, systematicity, reliability, responsibility, punctuality, accuracy and perceptiveness, high personal culture, honesty, initiative, humility and discipline, flexibility and adaptability to new conditions, willingness to learn, independence, efficiency;
2. Executive competences, that is:
 - company competences - identification with the company and the team, professional knowledge, knowledge of foreign languages;
 - managerial competences - team building skills, strategic thinking and change management, problem solving skills.

These standard solutions are not used today in an economy where the development of enterprises takes place in a non-linear, virtual, remote and comprehensive manner, most often as part of functional integrations.

4. Competences of the Industry 4.0

Particular sectors of the economy have similar problems related to the inhibition of demand for products and services during particular lockdowns. Breakage of supply chains, problems with the mixing of people and goods, freezing of tourism, gastronomy and entertainment are just the tip of the crisis. In this context, the development towards economy 4.0 turned out to be a catalyst for changes also in the labor market and the sought-after specialists. The state of the epidemic revealed, e.g. shortcomings in the competences of employees, such as³:

- inability to adapt to changes (indicated by 34% of respondents),
- innovation and creativity (34%),
- lack of courage to act in a new situation (28%),
- mental strength and resilience (28%)
- self-organization of work (26%).
- proactivity (25%),
- lack of competence to remotely manage a team among the group of managers (16%),
- fast learning skills (14%),
- IT skills (13%).

Analyses have shown that in the labor market the skills that are easily acquired through the system of professional development are not so important as the attitudes, character and good habits of self-organization. At the same time, the attitudes of openness, adaptation and creativity are the most valued, while until now reliability in carrying out standard tasks was valued. An additional problem is the lack of training and professional development in many companies and institutions - only less than half of the companies train their employees. The available research shows that 58% of actively employed people do not raise their qualifications. They practically do not show any activities aimed at being up to date in the area of their professional interests. So if we compare both those numbers: employers who train employees and employees who do not improve their own qualifications, the number of people who do not develop on a professional basis and do not even feel responsible for self-improvement of their competences is very high. It is worth emphasizing that, on the one hand, we have expectations of companies that employees will motivate themselves to work, on the other - employees who must discover new skills and, above all, must switch from being present in the office to task-based work. The situation is therefore a stalemate.

So what are the changes in the area of sought and required employee competences in the new reality? Based on the available information and statements of experts related

³<https://www.prawo.pl/kadry/nowe-kompetencje-pracownikow-potrzebne-w-pracy-zdalnej-nowa,501788.html>.

to the sphere of human resource management in enterprises, it can be mentioned that the following are the most important:

- digital skills related to remote work in the company and customer and petitioner service (telemarketing, chatbots, etc.) as well as student or student service,
- as part of the work or study provided,
- the ability to support and use cloud technologies, e-commerce, software robots and artificial intelligence in business and production,
- skills related to the development and operation of processes in the field of automation and robotics at the expense of manual work related to assembly,
- self-organization of work, especially in conditions of isolation or remote work, the importance of which will undoubtedly increase after the epidemic passes,
- mental resilience, related to the need to organize an individual work system, also taking into account the lack of direct contact with the supervisor and other colleagues,
- adaptability, adaptation to change as a useful phenomenon, taking up challenges and the necessity to change the sector often related to it. In many highly developed countries struggling with the phenomenon of an aging society, as a result of complications related to coronavirus infection, there has been an avalanche increase in the demand for medical personnel, nursing, care, physiotherapy and psychological assistance. Such phenomena make it necessary to change the industry even faster and acquire new skills and professional abilities,
- creativity and innovation is another competence area intensified by the new situation. Many industries were closed as a result of successive versions of the lockdown or limited their activity to a great extent. This forced entrepreneurs to search for new business opportunities,
- using new opportunities and communication channels to a much greater extent, both at the level of the company and customer relations (e.g. sales channels or acquiring new customers) as well as in the search and acquisition of new projects and contracts,
- personal development skills (learning and studying) and professional development (training, qualification improvement) with limited availability of traditional methods and content (libraries, reading rooms, studies and stationary courses), and as a result transferring this activity to online and offline methods
- a significant increase in trust in interpersonal relations, both of the superior to the employee - that he works efficiently and performs his work within the constraints associated with remote work, as well as the employee to the supervisor that he will secure his social, health, financial functions, even the workplace as such.

The pandemic has resulted in the reduction of employment for a significant number of occupations. In some professions, the demand for employment remains permanently low. However, the professional groups that are currently experiencing a strong increase in job offers are professions related to e-commerce services, moreover, digital manager, business intelligence specialists, UX designer, Big Data specialists, application developers, infrastructure specialists and automation engineers. Based on the latest available labor market research during the pandemic in Poland (Grant Thornton, Labor market during COVID-19, VIII edition, October 2020), those changes in the demand for individual occupations in the following groups are presented:

1. Finance:
 - chief accountant: + 33%
 - accountant / accounting specialist: + 2%
 - financial analyst: - 7%
 - financial director / CFO: - 11%
2. Marketing / sales:
 - e-commerce specialist: + 55%
 - marketing / sales director: + 1%
 - marketing specialist: -18%
 - schedule: - 36%
3. IT:
 - cybersecurity specialist: + 100%
 - CIO / IT director: + 25%
 - developer: + 3%
 - IT administrator: + 3%
4. Health protection:
 - paramedic: +34
 - doctor: + 21%
 - nurse: + 19%
 - indoor / outdoor: - 19%
5. Physical work:
 - driver: - 0.5%
 - warehouse worker: - 14%
 - security officer: - 20%
 - cashier / salesman: - 31%.

The above list clearly shows the growing market demand for groups of employees with highly specialized professional qualifications - accountants, paramedics and doctors, as well as cybersecurity specialists or an e-commerce specialist. It can be clearly concluded from this that the virtual work environment becomes extremely important using the employee's digital competences, especially after taking into account the remote work widely used in the economy and remote learning caused by home isolation during a pandemic. On the other hand, the professions related to the provision of manual labor and unskilled workers (warehouse worker, security guard

or salesman) are losing importance. However, the hypothesis put forward by some researchers that the demand for manual labor and unqualified workers will decrease is not confirmed. Undoubtedly, the increase in the demand for high-skilled labor will increase, but manual and unskilled labor will be sought in a similar scope. Additionally, the most valuable is having high technical qualifications combined with soft skills, i.e. critical thinking or the ability to cooperate (Palacios-Huerta, ed., 2016). It has already been suggested that in the future the most desirable will be comprehensive problem solving, social skills such as cooperation with others and process skills, which include critical thinking or active listening (World Economic Forum, 2016). The situation on the labor market and the crisis of individual industries only confirmed that. The most difficult future may be felt by moderately qualified employees - it is estimated that the demand for work in this area will decrease (Holmes, Mayhew, 2014).

5. Discussion and Conclusions

The crisis caused by the coronavirus epidemic has shown that companies must introduce changes in the competency requirements of employees. The style of work changes, new skills acquire new meaning, such as: adaptation to changes, mental resilience and self-organization of work. Nowadays, competences should be understood as a synergistic combination of: general knowledge, skills, attitudes, personal characteristics, social roles and ideas about oneself - therefore they are the basic component of the proper performance of work (Boyatzis and Dudzińska-Głaz, 2012, p. 86). These elements take on particular importance not only in the context of a pandemic, which was rather a catalyst for changes that had started earlier. The main focus of changes were the distinguishing features of economy 4.0, related to the intensive development of technology. According to the "Success personified in the Fourth Industrial Revolution" report, the speed with which everything changes is growing at a surprising pace, production cycles are shorter, and innovation is a constant element in the processes of increasing the competitiveness of enterprises. The orientation of economies is changing: from products to services, and the observed "tension between hope and ambiguity" clearly indicates that competence providers were completely unprepared for such rapid changes (Deloitte Insights, 2019).

In sum, the article presents the following research questions:

1. Does the modern education system respond to the needs of the 21st century organizations?
2. Which competences can be considered crucial for the organization in the economy 4.0?

The answer to the first two questions is presented in the article. In addition, the thesis was verified that there were differences between professional competences (i.e., behavior, abilities and skills of an employee before the period of rapid changes

caused by the pandemic and virtualization of manufacturing processes) and the actual competences of employees required in Industry 4.0. It was found that these differences result mainly from the inability to adjust study programs to the rapidly changing market requirements.

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