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EDUCATION, COMPETENCES - LABOR MARKET ANALYSIS AGAINST THE CHALLENGES OF INDUSTRY 4.0 ECONOMY

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Abstract: Building a strong economy depends on numerous factors: technological, political, geographical but also and above all social ones. Currently, the ongoing fourth industrial revolution is primarily based on digitization of all processes in the conducted activities. The acquisition and processing of vast amount of data generates information which is very complex and not always unambiguous. Industry 4.0 also assumes that employees will understand both technical needs and those not related to the production process. This means that the present education system (definitely the one related to technical science) should also be changed so that engineers acquire more managerial skills. The article presents the educational assumptions in the face of challenges posed by Industry 4.0 in the context of the current opportunities of the labor market and education in Poland and in Europe.
Keywords: Industry 4.0, education, competences

1. INTRODUCTION

The labor market is the place where many different communities meet. These differences are, among others, due to a generation gap. In turn, generations have their expectations and sometimes limitations. In accordance with the concept of sustainable development (Pawłowski, 2009; Polasky et al., 2019) and the equivalent concept of Industry 4.0 (Popkova et al., 2019; Schwab, 2016; Almada-Lobo, 2016), it is the society that is an important part of the market. Therefore, the cognition of human capabilities generates the degree of advancement of the implementation of assumptions of the fourth industrial revolution and the related labor market. Currently, in the labor market, the post-war baby boom generation are giving way to the most numerous generation known as millennials (Kong et al., 2019; Glazer et al., 2019). From the point of view of job creation and education of this social group, it is important to learn its strengths, which is definitely the Internet (as an integral part of their daily lives) and limitations, which include the lack of problem-solving skills. Therefore, it should be assumed that the education system ought to teach the competences desired and the working environment should provide jobs in which the acquired licenses will transform into abilities (Motyl et al., 2017).

The concept of Industry 4.0 is largely focused on digitization (Oliveira et al., 2019). Taking into account the digitization of the life of Generation Y, entrepreneurs should not have a problem with the implementation of changes in this area. New industry is new technologies resulting from e.g. an increase in performance of production process automation. The European Energy Group - Innogy Poland S.A., in cooperation with the analysts of SpotData (Innogy, 2019), published the report of the most important trends in the global industry on the basis of the so-called text mining method, extended to the expert analysis of the integrated and financial reports of 150 largest industrial companies in the world. (Innogy-Raport, 2019). According to this report, the activity areas of industrial companies primarily focus on *climate change*. This relates to: 1) the use of renewable sources of energy along with the energy efficiency technology (mainly dedicated to the industry processing metals, oil, mineral resources and production of machinery or beverages); 2) electrification, mostly directed to industries manufacturing vehicle parts, machinery and electrical equipment; 3) revolution in the area of packaging with an emphasis on the use of recycled materials and reduction in the consumption of plastic (mainly for the industry of processing chemicals and plastics, mineral resources and food). Another area is *digital transformation* characterized by: 1) the use of large data sets, the so called Big Data, mostly for production or optimization of business processes (concerning the industry of medical equipment, aviation and food processing); 2) the introduction of autonomous machinery and, thus, the use of learning machine technologies, which will be the most visible in the industry of manufacturers of machinery and equipment and transport equipment; 3) the adaptation of employees to new trends but not in terms of their training but rather the places where they will be replaced with machinery on a large scale (the transport industry). The last trend in the adjustment to the new industrial world is *organizational transformation*, which is mostly focused on the supply chain in relation to: 1) the acceleration of the process of the producer's response to the needs adapted to the customer's requirements. The changes may mostly affect the chemical processing industry due to their multifaceted cooperation with other industries; 2) the sales on online platforms relating to consumer goods but also the unified ones, like e.g. belonging to the metal processing industry; 3) an increase in the involvement of corporations in the process of the takeover of companies creating new business models. It is not so much dependent on the industry (although the research indicates the food and beverages processing) but the involvement of managers and the scale of the company's operations.
The above megatrends provide clear information of what to teach and who (skill profile) will be needed in the labor market for all economies of the world. According to the data by Innogy (Innogy-Raport, 2019), in recent years, Poland has indicated one of the most significant increases in industrial production in the European Union. The analysis of the last full 10 years shows that the industrial production in the country has increased by as much as 40%. On average, in the same period, in the European Union, it has fallen by 1%, and by 3% in the euro area. The report has also indicated that Poland is better prepared for global changes in organizational terms rather than technological ones. This translates into the lack of opportunities for using the latest digital technologies (robotics) but significantly internationalized relationships in the supply chain.

2. THE LABOR MARKET IN POLAND

According to the data published by the Central Statistical Office (GUS, 2019), the economic situation in the country indicates that, in the period of January to September 2019, compared to the same period the year before, there was recorded an increase in relation to: 1) average employment in the corporate sector +2.8%; 2) nominal/real average gross monthly wage in the corporate sector +6.8%/+4.6%; 3) prices of consumer goods and services +2.1%; 4) production price index +1.6%; 5) price index of construction and assembly production +3.6%; 5) seasonally un-adjusted index of sold production of industry +4.5%; 6) seasonally un-adjusted index of construction and assembly production +5.3%; 7) seasonally un-adjusted retail sales +5.8%; 8) international trade [in PLN]: imports +4.1% and exports 6.2%. (GUS - Analizystatystyczne, 2019). Detailed data describing the percentage changes in the last year, from June 2018 to June 2019, are presented in Figure 1.

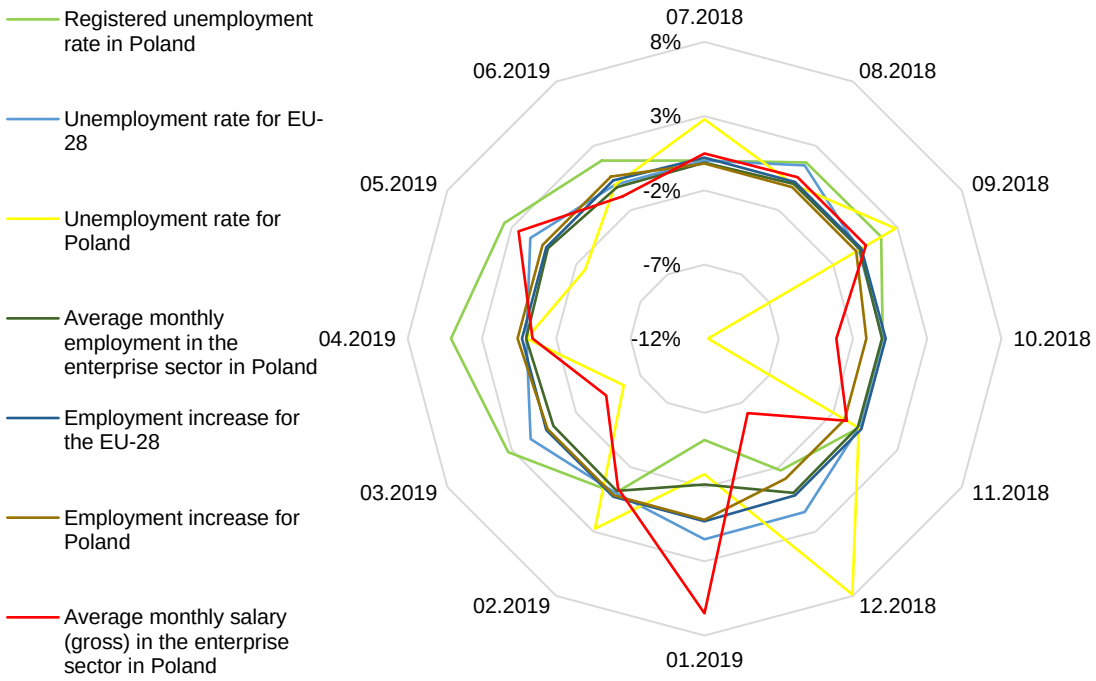

Fig. 1.Labor market in Poland - percentage changes in labor market from 06.2018 to 06.2019. based on data published by the Central Statistical Office and Eurostat.

The unemployment rate and employment growth both for Poland and the EU are given according to the methodology by Eurostat, the other data by GUS. The noticeable difference between the index and the rate of unemployment is due to the fact that, according to the Polish analytical tools, the unemployed are identified by the number of those registered in the Labor Office. In turn, European statistics assign them to the number of economically active people, studying or receiving pension. The presented data show that the changes, on average, fluctuated by +/- 2%. Declines in most periods related to the unemployment rate, which translated into increasing employment and wages. At the initial stage of the research, i.e. in June 2018, the registered unemployment amounted to 5.9% (according to Eurostat: 3.6% for Poland and 6.8% for the EU) and the average wage and employment amounted to PLN 4848.8 and 6222.1 thousand people. One year later, these values respectively amounted to: 5.3% (3.8%

and 6.3%), PLN 5104.46 and 6393.2 thousand people (IARP, 2019). Therefore, this situation can be found good for the labor market – taking into account the number of jobs – for employees. Increasing wages and great opportunities for selection of jobs should encourage to take up employment. However, such a nature of working conditions may be unfavorable for employers. In the era of changes, an investment in employees may not result in return due to, e.g. frequent labor migration. Such a situation can be avoided by taking care of competences needed to operate in the economy, both on the side of employees and employers.

3. COMPETENCES IN POLAND

The adjustment of the competence profile of employees to the needs of employers (Ulewicz and Sethanan, 2019; Nitkiewicz et al., 2019) is one of more important components of the developing economy. However, it is not an easy process and requires many changes in many areas, matched in time.

In order to learn market preferences and capabilities of employees in terms of competences, the Polish Agency for Enterprise Development and the Jagiellonian University, under the European Social Fund, published the results of the report within the framework of VII edition of the Human Capital Study (BKL – Bilans Kapitału Ludzkiego). The assessment of the situation in the Polish labor market was supported by the analysis of data acquired from the survey conducted among employees, the population and training institutions in the years 2014-2018 (BKL, 2019).

The report allowed the identification of employment needs (taking into account both the capabilities of Poles of working age and the needs of medium/large enterprises) and particularly competence shortages/deficit in specific occupations. On the basis of the report, in the north-western region of Poland, more than 50% of the surveyed companies searched for employees. These were mostly enterprises which introduced innovation/generated profit over the last 12 months and operated in the market of health care and social service. The detailed division of labor demand broken down by occupations is presented in Figure 2.

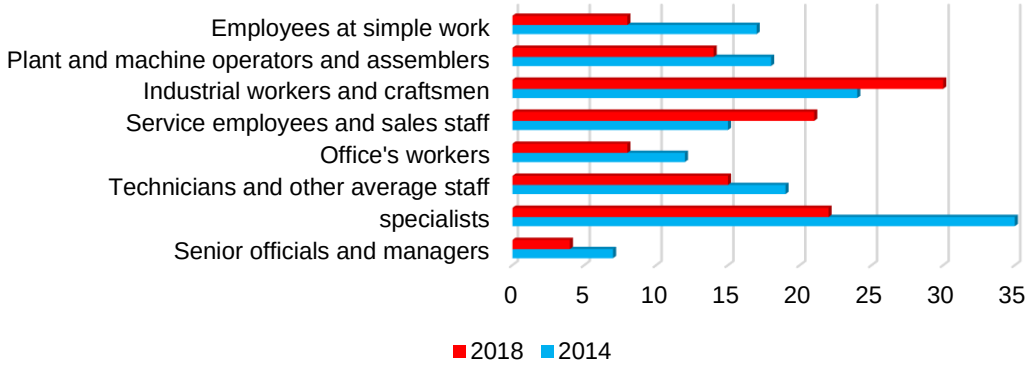

Fig. 2. The structure of demand for workers in various professions [in%] based on the data from the report of Human Capital

Source: (BKL, 2019)

The results of the conducted research within the framework of the continuation of the Human Capital Study allowed the indication of changes in preferences of groups of occupations searched for at the end of 2014 and 2018. The greatest demand in VI

edition occurred for the group of people being specialists and, in this year edition, for the group of industrial workers and craftsmen. It can be concluded that both groups achieved the highest results over 8 years and the demand for them is still insufficient. On the other hand, specialists are the largest occupational group of the unemployed or those searching for jobs. Therefore, it is important to match the competences declared by employees to competences required by employers. Non-compliance in terms of employment profile can be defined using index of dissimilarity, describing the level of structural mismatch (Czarnik and Kocór, 2015). The results of the research conducted under BKL 2014-2018 indicate that the most desired competences are: independence and punctuality, interpersonal skills and skills associated with learning new things, creativity or data analysis with reasoning. A detailed summary of competences declared by employers compared to self-assessment of competences of employees is presented in Figure 3.

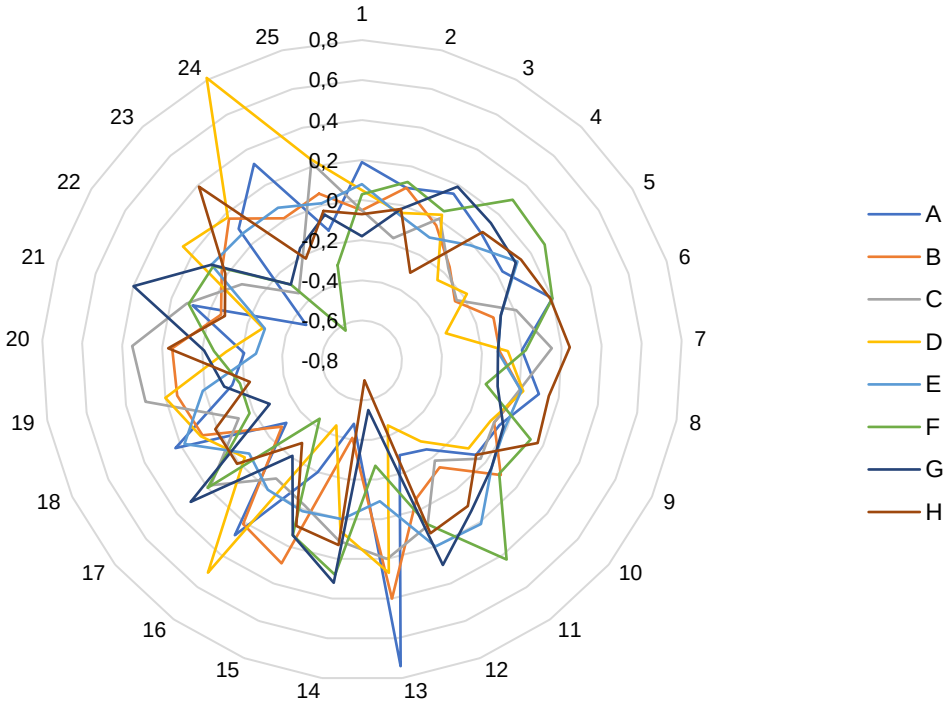

Fig. 3. Competency balance (difference between self-assessment and double-centered data requirement). Prepared on the basis of data from the Human Capital Balance report (BKL, 2019)

Legend:

1-25 Characteristics of competences: 1. Willingness to take responsibility. 2. Time management and punctuality. 3. Independent work organization. 4. Being communicative and clear communication of thoughts. 5. Interacting with people easily. 6. Handling stressful situations. 7. Group work. 8. Learning new things. 9. Inventiveness, creativity. 10. Information analysis and drawing conclusions. 11. Proficiency in Polish language. 12. Making use of the computer, tablet, smartphone. 13. Physical fitness. 14. Resolving conflicts between people. 15. Performing simple calculations. 16. Operating machines, tools and technical equipment. 17. Coordinating the work of others. 18. Willingness to work at unusual times. 19. Operating specialized computer programs. 20. Administration work and recordkeeping. 21. Cooperation with people of different nationalities. 22. Performing advanced mathematical calculations. 23. Willingness to travel frequently and change jobs. 24. Assembly and repair of machinery and technical equipment. 25. Artistic abilities.

A-H Characteristics of occupational groups: A: managers, B: specialists, C: technicians and mid-level personnel, D: office workers, E: personal services workers and salespeople, F: skilled workers, G: machinery and equipment operators and assemblers, H: unskilled workers.

4. CONCLUSION-THE MARKET, COMPETENCES AND INDUSTRY 4.0

Industry 4.0 generates numerous needs resulting from the necessity to introduce changes. They relate not only to the area of production or technology but also the social one. Relativity of the assumptions of sustainable development as well as the assumptions of the fourth industrial revolution makes education – its benefits to the society – an important part of the whole process of economic development. Therefore, knowing the preferences of employers and capabilities of employees, it is possible to create the society (professionally) in order to develop the economy globally. This thesis can be initially verified by comparing the research result discussed in the article to the results of the research conducted under the international project entitled "Curriculum Development of Master's Degree Program in Industrial Engineering for Thailand Sustainable Smart Industry (MSIE4.0)", published by the author in her earlier works (Wiśniewska-Sałek, Hussadintorn Na Ayutthaya, Mequita, Chattinnawat, 2019). The key factor allowing for specifying whether employers are ready to implement the assumptions of Industry 4.0 is the indication of who is needed to make this process take place:

- the results of the MSIE 4.0 project have indicated that the statistical employer has already had employees possessing non-technical skills such as systems thinking and process understanding (although their level is not sufficient yet) but the newly-employed ones will be required competences associated with: automation technology, IT infrastructure and data security/communication security.
- the results of the BKL project have indicated that employers will search for specialists and workers/craftsmen who possess the competences of independence, punctuality, who have interpersonal and cognitive skills.

This comparison has indicated clearly that both studies relate to the same competences but in a different time dimension. Current needs resulting from the BKL research are the continuation of the requirements in relation to employees, noticeable in the analysis of the MSIE 4.0 project research. Therefore, it can be concluded that the research carried out through these two projects confirms the appropriateness of educational assumptions being the end result of the MSIE 4.0 project. Building new/innovative (directed to the implementation of learning outcomes and not the process of transferring knowledge itself) study programs based on international cooperation will allow the development of the so-called soft competences while simultaneously educating specialists operating in enterprises fully adapted to the fourth industrial revolution.

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