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# MAN AS THE SUBJECT OF MANAGEMENT – IN THE OPINION OF STUDENTS OF ECONOMY 4.0

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**Abstract:** The introduction of technical and technological changes typical of industry and economy 4.0 in Polish companies makes it easier to build a competitive advantage. Implementing them requires providing the economy with suitably qualified employees who are prepared for work under new conditions. These employees are expected to be not only professionals in their field, but also to be willing and able to respond flexibly and quickly to new solutions in the work environment. They should also be capable of reorienting their knowledge and skills so that they are in line with the changing expectations of employer and labor market. Universities should, hence, prepare current students for such situation, Thus, this article presents a study conducted among students, the aim of which was to gather knowledge about whether, in the opinions of students, universities are preparing future employees for future professional roles and the challenges of the labor market in economy 4.0.

**Keywords:** industry 4.0, economy 4.0, human resources, qualifications, management.

## Introduction

For several years, the marked success can be seen in the domestic and international markets, of companies that use technologies based upon the integration of intelligent machines and production systems. These entities are also creating new kinds of solutions in areas related to the employment and management of human resources. This effect is in accordance with changes in the role of man in the system of production, distribution and sales. Simultaneously, the bankruptcies of companies that were giants a few years ago, but did not modernize quickly enough, indicate that in the modern economy, it is impossible to achieve success without implementing modernization programs and basing operations on the latest scientific achievements (Schwab, 2018, p. 92- 98).

It should also be noted that, often, these current technological and organizational solutions raise anxiety, a sense of threat and unwillingness to participate on the part of employees and

employers, because they are accustomed to conventional operating principles. The basic reason for this seems to be the typically human fears related to the necessity to acquire new skills and to the lack of knowledge about conditions of function in the new economic reality.

New technical and technological solutions that cause concern include, but are not limited only to, industry, economy and also society 4.0. These terms mean, inter alia, the way in which the economy and its elements operate wherein real and virtual worlds interact in many ways, and which is becoming the backbone of manufacturing, distribution and sales processes, as it enables introduction of new types of relationships between companies, suppliers and customers (Herman et al., 2015, p. 3).

It cannot be denied that that the changes that await contemporary and future employees resulting from dissemination of 4.0 industry solutions affect the functioning of economies and societies. The changes are immense and will require individuals to constantly acquire new skills, albeit, while supported by substantive accessible knowledge.

One can also be sure, that completely new professions will appear and some traditional ones will disappear – in other words, that the labor market will be completely redefined. Based on current processes, it can be expected that demand for task employment, project work, work on demand and other flexible forms of employment will increase. Moreover, demand for employees in the sphere of services, including professional ones, will also increase. At the same time, in a number of industries (e.g. construction and renovation), demand for employees with a high level of practical skills, who can also flexibly implement innovative work methods, will stay (Pascall, 2017).

Concepts related to implementation of industry 4.0, unlike concepts such as Computer Integrated Manufacturing, do not assume creation of enterprises in which computers and their systems will eliminate people from production or logistics processes. In industry 4.0, they are supposed to guarantee better and safer working conditions for people through the support of information systems (Orlitzky et al., pp. 19-21). However, for this to happen, a person must be prepared for changes in way that person functions in their employment and must show a high level of mobility in work environment, in order to not only follow changes, but to be also able to initiate and implement them. This, in turn, leads to a modification of principles and methods of conducting business and in the behavior of the economy as a whole, followed by social changes. Universities should prepare students for such form of being active in the economy, including within industry. That is why a study was undertaken which asked students of the Czestochowa University of Technology to what extent they feel prepared for such active and creative presence on the labor market. Students of the University of Humanities and Sciences of J. Długosz in Częstochowa were invited also as a control group, and the presentation of the key conclusions is the purpose of presented article.

## Economy and industry 4.0 – literature review

For millennia, human management was been based on entrepreneurship and ingenuity. This formed the source of success, progress and economic development. Till this day, it can be said that these factors are still of fundamental importance, but their specificity is changing. This change can be grouped into epoch depending on the driver.

With the invention of the steam engine and the mechanization of production resulting from this, the world economy entered the era of industrialization, referred to as economy 1.0 (Kiepas, 2018, p. 49). The accelerant for further development was electrification and its displacement of steam engines, i.e. the emergence of economy 2.0. At the end of the 1960s, the world experienced another "revolution" during which the development of the 3.0 economy that was based on digitization, began. Computers, which are more and more complex, first mastered all areas of manufacturing industry, where they were used in planning and control processes, and above all to streamline and increase the quality of the production process. Later, they found application in other areas of the economy, as well in non-profit organizations or in everyday human life.

Progressive development of IT systems, creating networks and facilitating communication thanks to Internet, as well as significantly reducing the cost of data storage, has enabled a gradual transition from the economy of 3.0 to 4.0 (Furmanek, 2018, p. 59). A typical phenomenon for this economy is dissemination of processes consisting of integration of intelligent machines and their systems, as well as introduction of changes in production processes and provision of services, the purpose of which is to increase production efficiency and introduce possibility of flexible changes in assortment, enabling directing individual offers tailored to client's needs (Jacobsen, 2012, p. 16).

Industry 4.0 cannot be reduced only to the technology based on the concept of cyberphysical systems. It also includes new ways of working and changing the role of man in the economy, especially as an employee. In industry 4.0, man becomes a most important element of a company's capital, and crucial when it comes to its success or failure and in determining the possibilities of its development in all functional areas (Ehnert, 2009, pp. 68-69).

Economy 4.0 is understood as a term describing activities aimed at combining technology and the added value chain (a collective term for technologies and concepts of value chain) (Hermann, 2015, p. 13). It is assumed that in this economy, full computerization of traditional industries will take place, and this process will not be of a revolutionary character, changing a functioning reality of enterprises in a short time. This process should be perceived as an element of continuous evolution, which over the past 200 years has clearly accelerated (Maślanek, 2014). The determinants of this evolution are computerization of traditional sectors and branches of economy, and the process of gradual blurring of borders between individual enterprises (Almada-Lobo, 2016, p. 19).

As examples of application of fourth revolution, autonomous vehicles, new materials (graphene) or advanced robots cooperating with humans, as well as 3D printing are most often indicated (Schwab, 2016). Key solutions for economy 4.0 also include intelligent intersection networks, which we encounter on a daily basis when using means of communication in cities, or embedded systems, such as airbags fitted in cars, which improve driving safety (Hermann et al., 2015, p. 17). This view on 4.0 industry and economy finds support in a fact that for a number of years solutions typical for 4.0 (i.e. cloud computing technology, big data, Internet of Things, or 3D printing) have been successfully used by more and more enterprises and non-business organizations as well, and their use does not raise employee concerns or objections (Morrar et al., 2017, p. 15).

This does not mean, however, that there are no problems related to the functioning of the 4.0 economy. There are already issues of ethical use of modern machines, as well as liability for their errors and improper operation. According to some researchers, along with dissemination of industry 4.0, there will be changes in approaches to responsibility – that sole responsibility will be replaced by joint responsibility, or preventive responsibility, in which man and organization bear the full consequences of any irregularities arising from work that is not theirs, but made by the robots and IT systems they manage (Lee, and Kim, 2012, p. 301).

Approaches to running a business will also change, some even speak of a "new business philosophy", in which the need to take into account the social good and environmental care within the management process becomes a standard (Lee, & Kim, 2012, p. 292). In doing so, the guidelines for sustainable development (SD) and corporate social responsibility (CSR) are included in the management process of the 4.0 industry/economy (Turner et al., 2018, p. 7). Many researchers also speak of the need to implement the assumptions of green management and green responsibility that are associated with positive environmental activity (Weng et al., 2015, p. 4998), for example, preventing its degradation and the modification of it that threatens the life and health of people, as well as all living organisms (Renouard, and Ezvan, 2018, p. 148). This approach will allow the more effective combination of areas of management, production and technology with activities to meet social needs (Renouard, and Ezvan, 2018, p. 149). It can be said that in undertaking this, it opens doors to economy 4.0 and the opportunities to gain competitive advantage that result from it (Zheng et al., 2014, pp. 417-419).

Efforts to include CSR in production processes can also be seen by introducing new working conditions for employees and mutual compliance with ethical standards in the course of cooperation with subcontractors and suppliers (Cheng, and Carrillo, 2012, p. 304). Such activities increase acceptance of innovations, including solutions related to introduction of the 4.0 economy, without employees being afraid of losing their jobs (Chang et al., 2011, p. 365). In this economy, man has become a most important element of the company's capital, an element that decides its success or failure and determines the possibilities of its development (Ehnert, 2009, pp. 68-69).

Popularization of the 4.0 economy means that on one hand, people stop noticing changes that occur thanks to it; rather they treat them as a natural element of modernization and the improvement of the quality of life. On the other hand, a question arises as to whether people who have just entered labor market or are about to enter in near future, are aware of the challenges that industry and economy 4.0 brings and whether they are prepared for them.

## Material and method

A fragment of the author's survey, the subject of which were student opinions on their preparation for functioning on the labor market in the economy 4.0, serves to answer the question ending the previous subsection. For the purposes of this study it was assumed that students of Polytechnic will have more knowledge about industry/economy 4.0 and better preparation for work within it than the general public. The survey was part of a pilot study conducted within two public universities: Jan Dlugosz University in Częstochowa (UJD) and Częstochowa University of Technology (MS) in Częstochowa. The research sample was 127 students of the Polytechnic, while 45 UJD students served as a control group. The sample was selected at random, each person who voluntarily agreed and met two joint conditions was invited to contribute. The two conditions were: he/she was a student of the last semester of the first or second degree studies in one of the three selected fields of study and knew concepts of industry and economy 4.0. The basic data characterizing the subjects are presented in Table 1.

The study was conducted at the university, during breaks between classes. Students were given a questionnaire to fill out, which began with information about the purpose of the study and instructions on how to complete it, followed by metric questions, and, finally, essential questions. The questions had a closed character.

**Table 1.**
*Study subjects*

| University | Field of studies | Degree | | Sum |
|---|---|---|---|---|
| | | *I°* | *II°* | |
| *MS* | *Mechanics* | 18 | 26 | 44 |
| | *Informatics* | 21 | 23 | 44 |
| | *Electronics* | 20 | 19 | 39 |
| Together | | *59* | *68* | 127 |
| *UJD* | *Pedagogics* | 9 | 9 | 18 |
| | *Dietetics* | 6 | 5 | 11 |
| | *Administration* | 8 | 8 | 16 |
| Together | | *23* | *22* | 45 |

Source: own study based on a questionnaire.

A five-point Likert scale was used, or in questions requiring evaluating, a numerical scale from 0 to 5, in which 0 meant total disagreement or completely negative assessment, and 5 implied full agreement or maximum assessment, was applied.

In the presented article, due to the need to adjust its size to formal requirements, only the distribution of respondents' answers (numerical and percentage) is presented. Furthermore, it is without a broader statistical analysis and only a small fragment of this survey is used. However, a wider study is being prepared for the monograph, which is undergoing development.

## Analysis of respondents' answers

The gathering of opinions on preparing students for active professional roles in industry/economy 4.0 began with determining where their knowledge on the subject comes from. For all students of the Polytechnic, the main source were their studies, while UJD students drew their knowledge from the media (36 recommendations) and from friends or family (6 people). Three could not indicate the source. The situation was similar when asked about the possibility of direct contact with technologies typical for industry and economy 4.0. MS students know these technologies and had the opportunity to learn the principles of their functioning during their formal education or at work. In contrast, among UJD students, only 17 knew the technological solutions of industry 4.0, and only 5 had direct contact with them. Therefore, it can be stated that these answers already show a wealthier knowledge about the studied subject exists among technical students.

Do their knowledge and experience automatically mean that MS students will think that they are better prepared for work and competition on the market in economy 4.0 than students of "soft" faculties? To determine this, the test subjects were asked whether higher education in the field they completed prepared them to work in 4.0 economy/industry conditions. The analysis of answers regarding this issue is a bit surprising, as it turns out that students of technical faculties assess their own degree of preparation for work in 4.0 technology conditions much more critically than did UJD students (Table 2).

**Table 2.**
*Level of preparation for work in industry/economy 4.0*

| University | Field of studies | Degree | Very weak | Weak | Hard to say | Good | Very Good | Sum |
|---|---|---|---|---|---|---|---|---|
| ***MS*** | ***Mechanics*** | I | 0 | 2 | 7 | 7 | 2 | **18** |
| | | *II* | *0* | *0* | *5* | *16* | *5* | ***26*** |
| | ***Informatics*** | I | 0 | 0 | 2 | 16 | 3 | **21** |
| | | *II* | *0* | *0* | *1* | *17* | *5* | ***23*** |
| | ***Electronics*** | I | 0 | 3 | 6 | 7 | 4 | **20** |
| | | *II* | *0* | *1* | *2* | *12* | *4* | ***19*** |
| **Together** | | **127** | **0** | **5** | **15** | **30** | **9** | **59** |
| | | | ***0*** | ***1*** | ***8*** | ***45*** | ***14*** | ***68*** |

Cont. table 2.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ***UJD*** | ***Pedagogics*** | I | 1 | 2 | 1 | 3 | 2 | **9** |
| | | *II* | *0* | *1* | *1* | *4* | *3* | ***9*** |
| | ***Dietetics*** | I | 2 | 2 | 0 | 0 | 2 | **6** |
| | | *II* | *1* | *0* | *0* | *2* | *2* | ***5*** |
| | ***Administration*** | I | 3 | 2 | 2 | 1 | 0 | **8** |
| | | *II* | *1* | *2* | *1* | *1* | *3* | ***8*** |
| **Together** | | **45** | **6** | **6** | **3** | **4** | **4** | **23** |
| | | | ***2*** | ***3*** | ***2*** | *7* | ***8*** | ***22*** |

Source: own study based on a questionnaire.

However, before opinions are presented on this issue, it must be mentioned that all MS students had professional experience consistent with their qualifications. In the control group, only 27 people had currently worked or had such experience in past, and among those only 9 people were employed in the profession which they were educated to perform. Other members of this group, apart from student internships, did not have professional experience.

Among the UJD students, there are proportionally many people who think that their studies prepared them well for work in the upcoming market conditions. At the same time, it should be recalled that they learned about this economy from sources outside of the teaching system. Although the control group is much smaller, proportionally more people from it assess the condition of their preparation as a very good: 17.39% of students in the 1st year and 36.36% of the second year, while among students of the Polytechnic, it is 15.25 and 20.59%, respectively. It should also be emphasized that among MS students, there are significantly fewer people who assess their degree of preparation for work in new economy very poorly, while a significant proportion of UJD students assessed it as weak and very weak. The distribution of UJD students' responses shows a much larger discrepancy, while students of Polytechnic can be called cautious optimists.

Subsequently, it was asked whether the profession that the respondents are presently acquiring is needed in the 4.0 economy.

**Table 3.**
*Level of usefulness of the future profession in economy 4.0*

| University | Field of studies | Degree | Useless | Of little use | Hard to say | Useful | Very useful | Sum |
|---|---|---|---|---|---|---|---|---|
| ***MS*** | ***Mechanics*** | I | 0 | 0 | 0 | 5 | 13 | **18** |
| | | *II* | *0* | *0* | *0* | *9* | *17* | ***26*** |
| | ***Informatics*** | I | 0 | 0 | 0 | 12 | 9 | **21** |
| | | *II* | *0* | *0* | *0* | *19* | *4* | ***23*** |
| | ***Electronics*** | I | 0 | 0 | 0 | 9 | 11 | **20** |
| | | *II* | *0* | *0* | *0* | *11* | *8* | ***19*** |
| **Together** | | **127** | **0** | **0** | **0** | **26** | **33** | **59** |
| | | | ***0*** | ***0*** | ***0*** | ***39*** | ***29*** | ***68*** |

Cont. table 3.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ***UJD*** | ***Pedagogics*** | I | 0 | 1 | 3 | 3 | 2 | **9** |
| | | *II* | *0* | *2* | *2* | *3* | *2* | ***9*** |
| | ***Dietetics*** | I | 0 | 1 | 1 | 2 | 2 | **6** |
| | | *II* | *0* | *1* | *2* | *1* | *1* | ***5*** |
| | ***Administration*** | I | 1 | 2 | 2 | 2 | 1 | **8** |
| | | *II* | *1* | *0* | *2* | *2* | *3* | ***8*** |
| **Together** | | **45** | **1** | **4** | **6** | **7** | **5** | **23** |
| | | | ***1*** | ***3*** | ***6*** | ***6*** | ***6*** | ***22*** |

Source: own study based on a questionnaire.

The Polytechnic students' opinions on this subject are not very diverse. Almost everyone believes that their would-be profession will be at least useful in industry and the economy 4.0. However, the opinions among UJD students are much more divided. Indeed, some individuals even think that their future profession may be completely useless in this economy.

A degree of pessimism regarding these issues is also evident in their statements regarding the need to change profession and acquire new qualifications. A large proportion of students of "soft" fields of study (69.5%) believe that over the next ten years, they will have to retrain at least 2-3 times. In contrast, the majority of students at the Polytechnic (73.8%) say they will not need a radical change of profession to function effectively in the labor market.

The last issue, which was highlighted in this study, applies to concerns about finding a job consistent with qualifications after graduation. This time the question was not whether there will be work in the modern economy or other areas, rather, it was a general assessment of the respondent's one opinion on his or her employment possibilities. The results of this assessment show that students of the Polytechnic again were more optimistic. Most of them, as already mentioned, were working at the time of the survey, while the few who were unemployed did not anticipate problems finding a job that would meet their expectations. The opinions of the UJD students are definitely less optimistic. While 82% of them are not afraid of being unemployed, and 18% believe that they may have periodic problems finding work in their filed of study, they are aware of the fact that the job they will find may not match their formal qualifications and ambitions, and above all, they may have problems finding anything of merit (Table 4).

**Table 4.**
*Probability of finding a satisfying job after graduation*

| **University** | **Field of studies** | **Degree** | **No possibilities** | **Little possibilities** | **Hard to say** | **Big possibility** | **No problems** | **Sum** |
|---|---|---|---|---|---|---|---|---|
| ***MS*** | ***Mechanics*** | I | 0 | 0 | 0 | 6 | 12 | **18** |
| | | *II* | *0* | *0* | *1* | *6* | *19* | ***26*** |
| | ***Informatics*** | I | 0 | 0 | 0 | 2 | 19 | **21** |
| | | *II* | *0* | *0* | *0* | *3* | *20* | ***23*** |
| | ***Electronics*** | I | 0 | 0 | 0 | 4 | 16 | **20** |
| | | *II* | *0* | *0* | *0* | *4* | *15* | ***19*** |
| **Together** | | **127** | **0** | **0** | **1** | **12** | **47** | **59** |
| | | | ***0*** | ***0*** | ***0*** | ***14*** | ***54*** | ***68*** |

Cont. table 4.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ***UJD*** | ***Pedagogics*** | I | 2 | 1 | 3 | 3 | 0 | **9** |
| | | *II* | *1* | *1* | *3* | *3* | *1* | ***9*** |
| | ***Dietetics*** | I | 1 | 2 | 1 | 1 | 1 | **6** |
| | | *II* | *1* | *1* | *1* | *0* | *2* | ***5*** |
| | ***Administration*** | I | 2 | 1 | 2 | 2 | 1 | **8** |
| | | *II* | *0* | *13* | *4* | *2* | *1* | ***8*** |
| **Together** | | **45** | **5** | **4** | **6** | **6** | **2** | **23** |
| | | | ***2*** | | ***8*** | ***5*** | ***4*** | ***22*** |

Source: own study based on a questionnaire.

It should be noted that 5 respondents from UJD who are currently at the first stage of their studies believe that they will not be able to find a job at all after completing education, and only 2 people are of the opposite opinion. Meanwhile, among technical students, only one respondent was not able to assess his chances on the labor market, while 47 graduating from first and 54 graduating from the second year are of the opinion that finding an attractive job will not be a problem for them.

Generally, despite the fact that the presented results are only a fragment of the study and they cover a small percentage of students, it can be assumed that it is much easier for people who graduate from technical studies to find themselves successful on the labor market than it is for those studying fields conventionally referred to as "soft". On the other hand, students of these faculties are much more optimistic about their chances as employees in industry and economy 4.0, although they are aware that they will have to retrain and that finding a satisfying job will require much more effort.

The study also shows that students of technical fields of study are better prepared to work in the environment of new technologies and probably also better understand the specifics of industry/economy 4.0. It also seems that those students are more suited to assessing possibilities of shaping their own professional career in enterprises using these technologies. This, however, does not allow concluding that the control group of students and their colleagues have no chance for creative professional development. However, in order to fully assess the possibilities and similarities and differences in functioning one the labor market in economy 4.0 of different groups of students and graduates of universities, it is necessary to undertake a broad survey, covering a much larger number and diversity of universities and students.

## Summary

To sum up, the changes related to implementation of industry 4.0 that occur and will occur in the future in the economy are a significant challenge for managers of enterprises and employees. They require constant learning of new rules on functioning in employment and running a business, and, at the same time, the need to learn is a prerequisite for the survival of enterprises on market.

Their effectiveness depends and will increasingly depend on knowledge and predisposition of employees and their professional mobility, especially that related to the ability to quickly retrain and acquire increasingly new competences.

When conducting research on these issues, it can be assumed that students of technical faculties, having hard qualifications and knowledge about new technologies, will be much surer of their own position on the market. This effect results from the qualifications they acquired during their studies and the possibility of their practical verification. This last is not available to students of "soft" faculties. The conducted study, a fragment of which was presented in article, shows that high self-esteem and self-confidence in the latter is more important than real knowledge and competence.

It is, however, difficult, due to insufficient sample, to assess the actual degree of preparation of respondents for work that is in accordance with the requirements of industry/economy 4.0, but it is certainly possible to speak about the faith of young people in their own strength and skills, even if they lack "hard " knowledge. For success, this faith, it can be concluded, is often more important than possessing actual skills.

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