INDUSTRY 4.0 AND THE PERCEPTION OF BASIC CONCEPTS BY EMPLOYEES WITH DIFFERENT EDUCATIONAL BACKROUNDS

Marián Díreš – Soňa Chovanová Supeková

Abstract

The development of Industry 4.0 in recent years has affected the entire industrial sector. The new paradigm of industry is changing the overall view of the economy. The sector is experiencing a problem of staff resources at different levels of education. The Slovak economy is dependent on industrial production. The individualisation of industrial products is coming to the fore, which is pushing for increased competitiveness. Our aim is to find out what is known about Industry 4.0. Finding out the cognizability of the concepts of Industry 4.0, computerization, attitude towards the innovative transformation of Slovak industry. We focused on testing four hypotheses aimed at differences in the perception of the topic of industry between respondents with two different types of education - on the one hand is the education of technical, economic, and natural sciences, on the other hand is the education of humanities, pedagogical and others.

Key words: industry 4.0, SME, internationalization, industry

JEL Code: F15, F18, F21

Introduction

The current bad economic situation caused by the COVID-19 pandemic points to changes in thinking. The aim of our research will be to develop a comprehensive view of the perception of Industry 4.0 and the problems in its application in the context of accepting the importance of industry for the Slovak economy. The acceptance of the idea of introducing smart industry by the Slovak public creates preconditions for the willingness to learn in individual teaching and study fields according to the new conditions.

In the article, we will draw attention to professional terminology related to the national building of individual brands of states and at the same time to the basic knowledge in the field of Industry 4.0.

Germany has a developed Industry 4.0 platform, which it is constantly improving due to changing conditions. The COVID-19 pandemic is one of the current strong influences that are putting pressure on the determinants of Industry 4.0.Among the various emerging technologies, much attention has been paid to the so-called 4th Industrial Revolution or Industry 4.0, which is a case study of a major initiative led by Germany. (Bonaccorsi, Chiarello, Fantoni a Kammering, 2020)Adhering to the term of *Industry 4.0*, which represents a radical transformation of the industry, the main result is the integration of emerging technologies. (Hermandez-de-Menendez, Morales-Menendez, Escobar a McGovern, 2020). Papulová (2020) states that there is currently no precise definition of the term Industry 4.0. Historically, scientific and technological development can be divided into revolutions. The number 4.0 in the name means that we are now in the fourth phase of the industrial revolution.

It is the solution of the COVID-19 pandemic using the technologies of Industry 4.0 that can be gradually transformed into the national braiding of the state that applies these technologies. The COVID-19 pandemic is causing significant economic damage. Many foreign authors dealing with Industry 4.0 point to the positive impact of Industry 4.0 in the fight against the COVID-19 pandemic. Many foreign experts point out the possibilities of the solution offered by the 4.0 environment.

The issue of providing professional inspections, professional tests, official tests should be implemented with the idea of Industry 4.0. Díreš, (2021)

Palestino et al. (2020) deal with specific research of the use of nanotechnology in the fight against the Covid-19 pandemic.

Decentralization of processes should also be related to individualization of products. We often ask ourselves whether it is possible to produce individual products cheaper than products from serial production. Industry 4.0 is supposed to ensure a positive answer.

Lean production is beginning to appear to be an important part of the national brand in the context of Industry 4.0.Building national brands deals with the overall image of the country on the international stage. It covers political, economic and cultural dimensions. (Antholt, 2007).(Conejo and Anhol, 2020) state that in the late 1990s the term "Brand of Nation, Regions and Cities" came to the fore. The advantage of a strong brand was that it allowed you to take advantage of exports, attracting tourism, foreign investments and talents.

The new Industry 4.0 concept will create new jobs that will be directly or indirectly linked to the manufacturing industry. Timely prediction of the necessary professional

competencies of the future is important. The result of the prediction should be directly linked to the creation of future educational needs.

Highlighting the need for different levels of vocational education, from apprenticeships, full secondary education to university education, enables the public to make a full decision on future employment at different levels of the smart industry. Extending the apprenticeship system, which provides some general skills to workers without higher education, and thus facilitates their later job mobility, is an important topic for future research. (Dauth, Findeisen a Suedekum, 2021)

This definition can be modified for the conditions of the merger of the Slovakia and Industry 4.0 brands. The Slovakia industrial brand is a way of perceiving and accepting Slovakia by foreign experts and investors in the field of smart industry. The brand and image building of the country come to the forefront with the development of international marketing. In the past, there were no precise definitions of brands.

Industry 4.0 requires changes in the labour market, and an environment supporting trained professionals with competences and skills is important. (Hermandez-de-Menendez, Morales-Menendez, Escobar a McGovern, 2020)

Project management serves as a very valuable application platform especially for the process of business innovation (Krchová, 2019).

(Chovanová, Krchová, Zbranek, 2020). Medium-sized enterprises accounted for 24% and large enterprises for 20%. A very important variable in the sample of enterprises studied was the sector of the economy in which the enterprise predominates. The largest group, 21% of enterprises, was from the public sector and the second largest group was industrial enterprises, 19%.In Slovakia, as in many countries around the world and in other CEE countries, consulting is not legally regulated. Anyone can set up a consulting firm without the need for a special consulting qualification, provided they meet the general economic and financial requirements for starting a business (Szeiner, Mura, Horbulák, Roberson, Poor, 2020). Every marketing communication tool is a means of attracting customers, retaining loyal customers, and broadening the spectrum of consumer perceptions of the product and brand (Chovanová, Krchová, Zbranek, 2020).

Material and methods

Our goal is to learn about Industry 4.0. Determining the recognizability of terms Industry 4.0, Informatization; attitude regarding the innovative transformation of the Slovak

industry. We focused on testing four hypotheses focused on differences in the perception of industry between respondents with two different types of education - on the one hand there is technical, economic and scientific education, on the other hand there are humanities, pedagogy and others. We use the statistical program IBM SPSS Statistics 20 for data processing.

Because we work with nominal (categorical) variables, a relatively large research sample, and independent observations, we use the Chi-square test to verify all hypotheses - a statistical nonparametric method used to determine whether there is a demonstrable relationship between two characters. We establish a null hypothesis and an alternative hypothesis. Based on the calculated value of p at the selected level of significance $\alpha = 0.05$, we decide on the confirmation or rejection of the null hypothesis and the subsequent acceptance of the alternative hypothesis. In all cases of hypotheses, the independent variable is the focus of the respondent's education with two categories. The dependent variable are the questions from questionnaire numbers 1, 2, 4 and 6, i.e. knowledge of the term Industry 4.0, knowledge of the term Informatization, perception of the importance of introducing a new paradigm of smart industry and consideration of the need to transform unprofitable manufacturing companies.

The strength of the relationship - association between variables is determined by means of association coefficients selected according to the size of the contingency table and the level of measurement. As we only work with nominal characters, only the size of the contingency table will decide. In the case of Hypothesis no. 1 and 2, where we work with a table of size 2x2, we use the coefficient *Phí*, in the case of Hypothesis no. 3 and 4, where we work with a table of size 3x2, we use the coefficient *Cramer's V*. The values of the coefficients range in the interval <0; 1>, and the higher the value, the stronger the relationship between the variables. A value of 0 indicates that there is no relationship. We will use the de Vaus interpretation (2002) to interpret the values of the coefficients. The effect of the quality factor under study on the explanatory variable is statistically significant (Stehlíková, 2003).

We use the coefficient of determination to determine on how many % the independent variable explains the variability of the dependent variable.

The research sample consists of 249 participants who filled in the electronic form of the questionnaire. From the socio-demographic characteristics, we focused on gender, age, education, focus of education and the region from which the respondent comes.

In terms of gender, 63.5% of men and 36.1% of women participated in the research. In terms of age, the sample is distributed as follows: 40.2% of respondents aged 18-30 years, 28.5% of respondents aged 51-60 years, 14.9% aged 31-40 years, 14.1% aged 41-50 years and 2.4% aged 60 and over. In terms of education, the research was attended by the most university-

educated respondents - 68.3%, of which 42.2% with a degree II, 19.3% with a degree I and 6.8% with a degree III. 31.3% of respondents had a secondary education, of which 21.3% had a school-leaving examination certificate and 10% had an apprenticeship certificate. The most represented focus is humanities, pedagogy and other education - 51.4%, 48.2% technical, economic and scientific. In terms of the region, the Bratislava region is the most represented - 24.1%, followed by the Banská Bystrica region - 16.9%, Prešov - 12.4%, Košice - 11.2%, Nitra - 10.4%, Trnava - 9.6%, Žilina - 8.4% and Trenčín - 6.8%.

Hypothesis no:

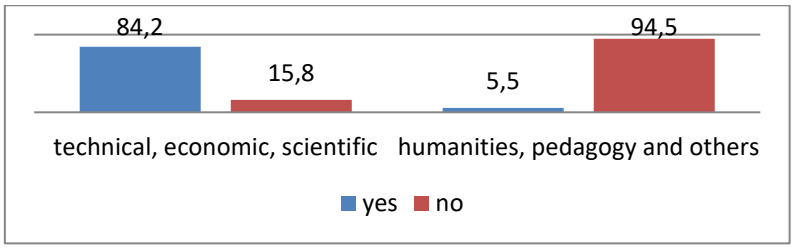
Hypothesisno.1: Respondents with technical, economic and scientific education, in contrast to respondents with humanities, pedagogical and other education, know the term Industry 4.0.

Hypothesis no. 2: There is no connection between the focus of education and knowledge of the term Informatization.

Results and discussion

Overall, 44% answered positively to the question whether respondents, regardless of their education, know the term of Industry 4.0, and 56% answered negatively. In terms of the focus of education, up to 101 respondents (84.2%) with a technical, economic and scientific focus know the term, on the contrary, only 7 respondents (5.5%) with the humanities, pedagogy and other focus. See fig. 1

Fig. 1: Do you know the term of Industry 4.0? (%)

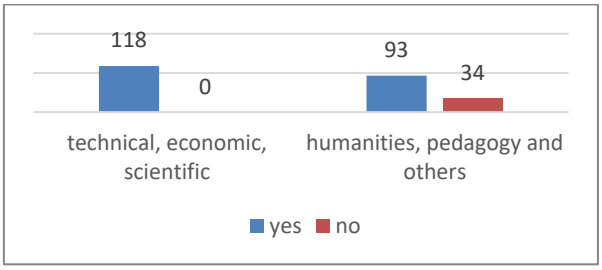


Source: own processing

Overall, 86.2% answered positively to the question whether respondents, regardless of their education, know the term Informatization, and 13.8% answered negatively. Three respondents did not answer the question. In terms of the focus of education, up to 118 respondents (100%)

with a technical, economic and scientific focus and 93 respondents (73.2%) with the humanities, pedagogy and other focus know the term. See fig. 2.

Fig. 2 : Do you know the term of Informatization? (%)



Source: own processing

Hypothesisno.1: Respondents with technical, economic and scientific education, in contrast to respondents with humanities, pedagogical and other education, know the term Industry 4.0.

They set the null hypothesis H0 and the alternative hypothesis H1:

H0: The knowledge of the term Industry 4.0 is the same for respondents with technical and humanities education.

H1: The knowledge of the term Industry 4.0 is not the same for respondents with technical and humanities education.

Fig. 3 : Chi-Square Test

	Value	df	Asymp. Sig. (2-sided)	ExactSig. (2-sided)	ExactSig. (1-sided)
Pearson Chi-Square	156,033[a]	1	**,000**		
ContinuityCorrection[b]	152,849	1	,000		
LikelihoodRatio	180,510	1	,000		
Fisher'sExact Test				,000	,000
Linear-by-LinearAssociation	155,404	1	,000		
N ofValidCases	248				

a. 0 cells (0,0%) haveexpectedcountlessthan 5. The minimum expectedcountis 52,26.

b. Computedonlyfor a 2x2 table

As the p-value is lower (p = 0.000) than our chosen level of significance α = 0.05, they rejected the null hypothesis and accepted the alternative hypothesis. We can state that there is an

association between the focus of respondents' education and their knowledge of the term of Industry 4.0. The differences found between respondents with different educational focuses are not only random and are statistically significant. We confirm the hypothesis no. 1. See fig. 3.

Hypothesis no. 2: There is no connection between the focus of education and knowledge of the term Informatization.

They set the null hypothesis H0 and the alternative hypothesis H1:

H0: There is no statistically significant connection between the knowledge of the term Informatization and the focus of the respondent's education.

H1: There is a statistically significant connection between the knowledge of the term Informatization and the focus of the respondent's education.

Fig. 4 : Chi-Square Test

	Value	df	Asymp. Sig. (2-sided)	ExactSig. (2-sided)	ExactSig. (1-sided)
Pearson Chi-Square	36,681[a]	1	**,000**		
ContinuityCorrection[b]	34,475	1	,000		
LikelihoodRatio	49,772	1	,000		
Fisher'sExact Test				,000	,000
Linear-by-LinearAssociation	36,531	1	,000		
N ofValidCases	245				

a. 0 cells (0,0%) havexpectedcountlessthan 5. The minimum expectedcountis 16,38.

b. Computedonlyfor a 2x2 table

Since the p-value is lower ($p = 0.000$) than our chosen level of significance $\alpha = 0.05$, we reject the null hypothesis and accept the alternative hypothesis. We can state that there is an association between the focus of respondents' education and their knowledge of the term Informatization. The differences found between respondents with different educational focuses are not only random and are statistically significant. We reject the hypothesis no. 2. See fig. 4.

Conclusion

Industry is an important part of the Slovak economy. Industry 4.0 is a new modern platform designed to ensure the competitiveness of individual industries. However, on the other hand, it can create an increasingly competitive environment. The general consent of the

company to the introduction of the new paradigm of the smart industry is important for the legal application. Our research found significant differences in the recognizability of the terms of Industry 4.0 and Informatization between individual respondents according to education.

We found that there are significant differences between the knowledge of Industry 4.0 concepts among graduates of different fields of study. Especially graduates from engineering, economics and science disciplines have knowledge of each of the basic concepts. Since the concepts of Industry .4.0 and Informatization are an important part of the future, it is necessary that general familiarization is also implemented in humanities schools.

The results of our research point to the problem of insufficient education, especially in the humanities. Industry 4.0 needs Society 4.0 for its application. Without a sufficient number of educated employees at all levels, the application of the Industry 4.0 platform in the Slovak Republic will be insufficient. Industry 4.0 affects the whole society and does not only apply to employees in the industry. The Industry 4.0 platform is one way to kick-start the economy after the COVID-19 pandemic. It is essential that the society knows the idea and benefits of the Industry 4.0 platform.

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Contact

Marián Díreš

Pan-European University in Bratislava, Slovakia, Doctoral student

Paneurópska vysoká škola n.o., Tomášikova 20, P.O.BOX 12, 820 09 Bratislava, Slovakia

marianddires@gmail.com

Soňa Chovanová Supeková

Pan-European University in Bratislava, Slovakia

Paneurópska vysoká škola n.o., Tomášikova 20, P.O.BOX 12, 820 09 Bratislava, Slovakia

sona.supekova@paneurouni.com