SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2024
ORGANIZATION AND MANAGEMENT SERIES NO. 196

PERCEPTION OF INDUSTRY 4.0

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Purpose: The purpose of this study is to understand opinions, beliefs and expectations regarding the introduction of new technologies and innovations related to the Industry 4.0.
Design/methodology/approach: The research tool was a structured survey questionnaire prepared by the author of the article. The survey was conducted in the first quarter of 2024 among 112 entrepreneurs from the Silesian Voivodeship.
Findings: The research results confirm that as the company grows, so does the knowledge about 4.0 technology and the assessment of the benefits of introducing modern technological solutions into company operations.
Originality/value: The value of the article is a look at the benefits, opportunities and factors inhibiting the implementation of 4.0 technology from the point of view of micro, small and medium-sized entrepreneurs.
Keywords: Industry 4.0, SME sector, new technologies.
Category of the paper: Research paper.

1. Introduction

Industry 4.0, referred to as the fourth industrial revolution, belongs to an advanced stage of using digital solutions in companies related to expanding the possibilities of simple automation (Schwab et al., 2019). This is the next stage of company development based on digital transformation, in which value chains, products, services and business models change. The development of Industry 4.0 (I4.0) is a model of ongoing transformation that has significantly influenced production capabilities used in various industries (Frank et al., 2019). The idea of Industry 4.0 was to implement the 2011 project as part of the German government's high-tech strategy in response to the needs of entrepreneurs to modernize production lines (Lee, 2013). Within this concept, intelligent systems, artificial intelligence, the Internet of Things and advanced robotics are the key elements of changes taking place in the industry. Thanks to this, production becomes more flexible, effective and automated (Vaidya et al., 2018). It should be mentioned that the latest industrial revolution has influenced not only industries, but also

people's everyday lives. For this reason, discussions on this topic are common - from scientists to entrepreneurs, governments and social organizations.

The purpose of this study is to understand opinions, beliefs and expectations regarding the introduction of new technologies and innovations related to Industry 4.0. The considerations are complemented by the identification of barriers and challenges related to the adaptation of Industry 4.0. Conducting such a research analysis would allow us to better understand current trends and challenges related to industry transformation and better prepare companies, employees and society for the new digital reality.

2. Perception of Industry 4.0 in the light of literature research

Industry 4.0 is a term used to describe a new phase of industry development, characterized by the intensive use of digital technologies and process automation. One of the key elements of this transformation is the growing role of perception in the context of technology, management and work (Sanders et al., 2016; Chen et al., 2017; Yang, Gu, 2021).

Literature research on the perception of Industry 4.0 focuses on various aspects of this phenomenon, including: in the context of: employees (e.g.: Kadir et al., 2019; Louw, Deacon, 2020), information and communication technologies (e.g.: Sanders et al., 2016; Zhou, Cardinal, 2019; Javaid, Haleem, 2020), innovation (e.g.: Bassanini et al., 2000; Nagy et al., 2022; Wolniak, 2023), sustainable development (e.g.: Ejsmont et al., 2020; Ghobakhloo,2020), smart cities (e.g.: Prosser, 2018; Yun, Lee, 2019) or various aspects of production (e.g.: Sanders et al., 2016; Frank et al., 2019) In a holistic approach, Beier et al. (2020) divided Industry 4.0 into four categories: people, technology, organization and features.

In response to the needs of the industry in relation to the development of digital technology, it is necessary to analyze the earlier stages in the development of the production industry, which contributed to the creation and development of Industry 4.0 (PwC Report, 2017):

- the first industrial revolution, which began in the 18th century, was based on the use of energy from watercourses and steam machines for the production of everyday products;
- the second industrial revolution began at the turn of the 19th and 20th centuries and was the result of electrification with the first use of modern production lines, which enabled the reduction of production costs and its massification;
- the third industrial revolution came in the 1970s with the use of the first industrial automation systems based on electronic circuits.

The fourth industrial revolution is the beginning of the 21st century and further automation of production using advanced robots based on three pillars:

- integration of IT systems vertically (between departments in the company) and horizontally (with suppliers, customers and cooperators);

- digitization of the product and service offer - adding elements of the Internet of Things to manufactured products;
- new, digital business models - replacing traditional industrial products with comprehensive solutions tailored to the needs of a specific customer, combining products and services, using electronic contact and sales channels.

Previous industrial revolutions were driven by single technological inventions such as the steam engine (1.0), electricity (2.0), and computers (3.0). In contrast, the ongoing fourth industrial revolution is driven by existing technological developments and the ability to process large amounts of data (Rupp et al., 2021).

In terms of the solutions undertaken, Industry 4.0 has transformed into a multi-faceted approach aimed at strengthening the competitiveness of the industry (Frank et al., 2019; Xu et al., 2021). It should be emphasized that activities within Industry 4.0 are based on technology, which is driven by the constant pursuit of higher efficiency. As an umbrella term, it encompasses a group of interconnected technological advances while emphasizing an increasingly digitized business environment (Xu et al., 2021). This perceived end-to-end technology integration not only transforms manufacturing processes, but also has profound implications for the broader industrial landscape.

Industry 4.0 therefore acts as a sophisticated digital system prepared to collect and interpret data at every stage of the production process, thus generating the acquired knowledge for decision-making (Chofreh et al., 2020). The digital efficiency of the system enables real-time monitoring and improved data and process integration. The specificity of the system thus obtained facilitates the exchange of live information between individual levels of organization in the corporation and the production environment (Morgan, O'Donnell, 2018).

The most important distinguishing features of Industry 4.0 include:

- combining the physical and virtual spheres of production,
- use of artificial intelligence and machine learning,
- integration of machines and production processes through digital technologies and the Internet (IoT),
- human-machine interaction (HMI technologies – Human Machine Interface),
- data analysis (Big Data).

The implementation of advanced IT techniques, information and communication technologies, as well as the virtualization of business models should be seen in the requirements and preferences of customers (Bembenek, 2017). It should be noted that these activities provided access to advanced tools, which in particular brought benefits to small and medium-sized enterprises (SMEs) (Dassisti et al., 2019). In addition to monitoring functions, Industry 4.0 tools also facilitate the collection of data on material flows, energy consumption and water consumption (Jena et al., 2020). These activities strengthen the competitive position of SMEs on the market and allow for updating data on an ongoing basis. When introducing Industry 4.0

solutions, enterprises focus on faster, smarter and more sustainable productivity. Implementing modern production and operations techniques combined with digital technology creates networked organizations that have the ability to use data to conduct intelligent physical activities, potentially transforming entire sectors. By introducing the latest technologies (robots, artificial intelligence, quantum computing, additive manufacturing and IoT) as intelligent technological connections are integrated in companies and assets (Zakoldaev et al., 2019).

Industry 4.0 allows SMEs to streamline their operations by using intelligent, technology-enabled machines. The resulting data is a key element used to gain expertise to perform operations faster and increase efficiency. The use of intelligent equipment and gadgets provides the opportunity to produce huge amounts of data, which are then used to gain insightful knowledge for the needs of excellent business analysis (Tayibnapis et al., 2018; Kempegowda et al., 2018). Industry 4.0 is characterized by the complex integration of intelligent devices, machines, and information technologies to create a digital production system (Javaid, Haleem, 2020). This paradigm aims to establish a controlled and intelligent network, using innovative digital technologies to meet consumer demands for high-quality and customized products (Bonilla et al., 2018).

One of the main advantages of Industry 4.0 is the integration of various modern technologies, culminating in the creation and implementation of Cyber-Physical Systems (CPS) (Frank et al., 2019). These systems are innovative "I4.0" solutions (Benitez et al., 2020), playing a fundamental role in transforming production landscapes. Examples include production lines that include reconfigurable production and mass customization into an integrated solution. These lines integrate sensors, flexible machines, real-time production planning systems, and collaborative robots, providing insight into the future of manufacturing systems that then enable seamless vertical integration between manufacturing and company information systems.

Although the concept of digitization, i.e. Industry 4.0, has different applications in different economic sectors, it has disrupted the work of all of them (Pedone et al., 2018). Industries that have embraced digitalization have benefited from improved both internal and external value chains, streamlined transactions and more accurate product delivery. Companies can benefit from the adoption of Industry 4.0, digital manufacturing and related connectivity, including increased flexibility, operational efficiency (Zakoldaev et al., 2019; Lobanov et al., 2019). Leveraging the digital revolution of Industry 4.0 by manufacturers provides opportunities to create digital twins of processes, production lines, factories and supplier networks. Information from IoT sensors, devices, PLCs and other entities connected to the Internet is collected to create a digital twin. Digital twins constructed in this way help companies increase productivity, improve processes and create innovative products. A properly shaped process allows manufacturers to make changes to the production process, for example to determine methods to reduce downtime or increase efficiency (Bhagat et al., 2022). Another advantage of Industry 4.0 is the ability to modify production lines, adapting them to customer expectations. The availability of 3D printing, software-based business models and cutting-edge technologies

enable manufacturers to quickly produce goods tailored to the individual needs of their customers. The advantage of Industry 4.0 technologies is the reduction of downtime, thereby providing real-time data that can then be used to quickly locate and solve problems (Rizvi et al., 2023). It is therefore expected that as manual factories are transformed into smart factories and Industry 4.0 is implemented, production will increase, which will result from better connections between entire organizations. In addition, businesses will benefit from the ability to increase flexibility, creativity, efficiency and customer satisfaction. Enterprises will have the advantage of providing highly personalized, custom-made and contextualized goods and services, which will ultimately increase value for the customer. It is therefore expected that Industry 4.0 will play a key role as an element of every organization in the processing industry (Alvan, Umarbeyli, 2023).

Although the implementation of integrated Industry 4.0 solutions has great potential, their implementation is complex and therefore requires specialized knowledge of a diverse set of technologies and skills. These tasks include proficiency in hardware, software, and digital technologies such as big data and artificial intelligence (Kahle et al., 2020). The complexity of modern solutions results from the multi-faceted nature of Industry 4.0, which affects a comprehensive understanding of the interdependence between various technological modules.

3. Methodology, research assumptions and characteristics of the research group

The aim of this study is to investigate the perception of Industrial Revolution 4.0 and to assess its perception. In this context, the study assumed:

- PB1 - assessment of knowledge and degree of readiness of companies from the SME sector to adapt 4.0 technology,
- PB2 - identifying the main benefits related to the implementation of innovative technologies in production processes and company management,
- PB3 - identification of factors that may inhibit or accelerate the transformation process.

To achieve the above assumptions, the author prepared a structured survey questionnaire. In accordance with the principle of disclosing respondents' data, the questionnaire was completed anonymously. It should be mentioned that simple, one-dimensional, balanced scales were used to present the measured values, which reflected the values assigned by respondents to the assessed features.

The prepared survey questionnaire was sent to 200 entrepreneurs running their businesses in the Silesian Voivodeship. Due to the low return rate, the study was conducted among working students of part-time studies at the Faculty of Management of the Częstochowa University of Technology in the following fields: Occupational health and safety, Management and

production engineering and Management. Ultimately, 112 (N = 112) correctly completed questionnaires were obtained for analysis. Characteristics of the research group in terms of such variables as: enterprise size, area of operation, business profile, duration on the market and market position show Table 1.

Table 1.
Characteristics of enterprises

Category	Variables	Number of enterprises	Percentage value
size of the enterprise	micro-enterprises	12	10,7%
	small enterprises	24	21,4%
	medium-sized enterprises	76	67,9%
area of operation	local market	11	9,8%
	regional market	41	36,6%
	domestic market	52	46,4%
	international market	8	7,1%
business profile	production	23	20,5%
	trade	12	10,7%
	services	33	29,5%
	mixed	44	39,3%
duration on the market	up to 10 years	7	6,3%
	10-20 years	77	68,8%
	over 20 years	28	25,0%
market position	start of business	9	8,0%
	average share	74	66,1%
	significant share	26	23,2%
	dominant position	3	2,7%
∑		**112**	**100%**

Source: own study.

Only enterprises from the SME sector participated in the study, of which the largest group were medium-sized enterprises - less than 68% of the total. The second largest group of surveyed enterprises were small enterprises (21.4% of the total) and then micro-enterprises (10.7% of the respondents). Taking into account the area of operation, the largest group of respondents were enterprises operating on the domestic market - 46.45 respondents, then on the regional market - 36.6% of the total. The study also included enterprises operating on the local market - 9.8% of the total and international market - 7.1%.

Taking into account another variable, i.e. business profile, it should be noted that the largest group of enterprises were mixed profile enterprises - less than 40% of the respondents, followed by service enterprises - less than 30% of the total. The next largest group were manufacturing enterprises (20.5% of respondents), while the smallest group consisted of trading enterprises (10.75 respondents). Taking into account the duration on the market, it can be noted that the dominant group in this category of variables is the group of enterprises operating on the market for 10 to 20 years - 68.8% of respondents, then over 20 years - 25% of respondents and up to 10 years - 6.35 respondents. The last selected variable, i.e. market position, showed that 66.1% of the surveyed enterprises are one of many with a similar, average market share, 23.2% stated

that they have a significant market share, 8% are in the initial stage of development and 2.7% have a dominant market position.

Taking into account the above characteristics, it can be concluded that various enterprises of various sizes, industries and market experience took part in the study. This makes the results more representative and can be generalized to a wide range of companies. The diversity of the companies participating in the study allows for a better understanding of the different perspectives and problems faced by companies in different sectors. Thanks to this, the study can provide more comprehensive and valuable information and recommendations for business practice.

4. Results and discussions

Based on the research of Taurino, Villa (2019), Kolla et al. (2019), the analysis of the obtained research results was related to the first category of variables characterizing the research group, i.e. the size of the enterprise. As stated by Rupp et al. (2021), small and medium-sized enterprises play a special role in research. This is due to the fact that this sector is characterized by reduced financial possibilities and the use of available technologies.

Therefore, this article interprets issues related to the perception of Industry 4.0 from the point of view of micro, small and medium-sized enterprises. Thus, reference was made to PB1 first, and the obtained results are presented in Table 2.

Table 2.
Test results for PB1

Analysis area	categories	N	%	MI	M	Ś	MI%	M%	Ś%
Level of knowledge	very low	7	6,3%	2	1	4	16,7%	4,2%	5,3%
	low	23	20,5%	5	9	9	41,7%	37,5%	11,8%
	medium	38	33,9%	4	12	22	33,3%	50,0%	28,9%
	high	35	31,2%	1	2	32	8,3%	8,3%	42,1%
	very high	9	8,0%	0	0	9	0,0%	0,0%	11,8%
∑		**112**	**112**	**100%**	12	24	76	**100%**	**100%**
Level of readiness for adaptation I 4.0	very low	4	3,6%	1	1	2	8,3%	4,2%	2,6%
	low	26	23,2%	6	8	12	50,0%	33,3%	19,7%
	medium	39	34,8%	5	12	22	41,7%	50,0%	28,9%
	high	32	28,6%	0	1	31	0,0%	4,2%	40,8%
	very high	9	8,0%	0	0	9	0,0%	0,0%	11,8%
∑		**112**	**100%**	12	24	76	100%	100%	100%

N - 112, MI - micro, M - small, Ś - medium.

Source: own study.

The obtained research results showed that there are differences both in the level of knowledge and the degree of readiness to adapt I 4.0. Micro-entrepreneurs are characterized by the highest level of knowledge (41.7% of responses). In their opinion, they are familiar with the assumptions of Industry 4.0, but have no knowledge of their practical use. The results regarding the degree of readiness for adaptation are similar. Also in this case, micro-entrepreneurs are mostly not convinced to use 4.0 technology, but nevertheless declare that they may decide to do so over time.

In the case of small enterprises, it should be noted that they:

- have a fairly good understanding of the idea of Industry 4.0, being able to indicate examples of implementations (50% of answers),
- are open to new technologies and willing to learn more about them and more about 4.0 technology (50% of responses).

The results for medium-sized entrepreneurs are completely different. The analysis of their answers shows that they are most ready to adapt 4.0 technology, planning to start using its possibilities as soon as possible. For this reason, they have the highest level of knowledge in this field. According to Pacchini et al. (2019), it is mainly interesting for those producers who are focused on technology in their operations. It is also worth emphasizing that SMEs often do not adopt new solutions, mainly because they fear investing in the wrong technologies or adopting inapt practices (Mittal et al., 2018). At the same time, the research results indicate that SMEs do not have the economic resources to implement Industry 4.0 technologies (Tubis, Grzybowska, 2022).

Taking into account PB2 and PB3 (Table 2, Table 3), it can be noticed that the opinions of individual entrepreneurs (micro, small and medium-sized) are at a similar level, i.e. having a significant impact. This means that both micro-entrepreneurs, small enterprises and medium-sized companies express similar opinions and positions regarding both the benefits and factors inhibiting the implementation of 4.0 technologies. This may indicate some uniformity in the approach to specific business issues or problems in the context under study. It is worth noting that each of the selected types of entrepreneurs has individual experiences and perspectives, which is why there are differences of views even within a given group of companies. Nevertheless, consistency of opinion among different types of entrepreneurs can be an important factor influencing decision-making and shaping business strategies. The issue of the impact of the Industry 4.0 phenomenon (positive as well as negative) has also been the subject of research by Adamik, Nowcki (2018), and Basl (2017), among others, indicating a growing interest in Industry 4.0.

Table 3.
Benefits related to the implementation of 4.0 technology

Analysis area	Categories	N	%	MI	M	Ś	MI%	M%	Ś%
increasing competitiveness	I have no opinion	8	7,1%	1	1	6	8,3%	4,2%	7,9%
	definitely insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	insignificant	4	3,6%	0	0	4	0,0%	0,0%	5,3%
	significant	62	55,4%	8	18	36	66,7%	75,0%	47,4%
	definitely significant	38	33,9%	3	5	30	25,0%	20,8%	39,5%
product personalization	I have no opinion	20	17,9%	1	7	12	8,3%	29,2%	15,8%
	definitely insignificant	1	0,9%	0	0	1	0,0%	0,0%	1,3%
	insignificant	7	6,3%	2	0	5	16,7%	0,0%	6,6%
	significant	56	50,0%	7	13	36	58,3%	54,2%	47,4%
	definitely significant	28	25,0%	2	4	22	16,7%	16,7%	28,9%
building closer relationships with customers	I have no opinion	15	13,4%	1	5	9	8,3%	20,8%	11,8%
	definitely insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	significant	64	57,1%	9	13	42	75,0%	54,2%	55,3%
	definitely significant	33	29,5%	2	6	25	16,7%	25,0%	32,9%
better adjustment to market requirements	I have no opinion	16	14,3%	2	5	9	16,7%	20,8%	11,8%
	definitely insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	insignificant	1	0,9%	0	1		0,0%	4,2%	0,0%
	significant	64	57,1%	10	8	46	83,3%	33,3%	60,5%
	definitely significant	28	25,0%	0	7	21	0,0%	29,2%	27,6%
faster response to changes	I have no opinion	29	25,9%	2	8	19	16,7%	33,3%	25,0%
	definitely insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	insignificant	1	0,9%	0	0	1	0,0%	0,0%	1,3%
	significant	56	50,0%	8	11	37	66,7%	45,8%	48,7%
	definitely significant	27	24,1%	2	6	19	16,7%	25,0%	25,0%
integration of processes in the enterprise	I have no opinion	10	8,9%	1	3	6	8,3%	12,5%	7,9%
	definitely insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	significant	72	64,3%	7	16	49	58,3%	66,7%	64,5%
	definitely significant	30	26,8%	4	5	21	33,3%	20,8%	27,6%
increasing employee productivity	I have no opinion	24	21,4%	0	8	16	0,0%	33,3%	21,1%
	definitely insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	significant	52	46,4%	5	14	33	41,7%	58,3%	43,4%
	definitely significant	36	32,1%	7	2	27	58,3%	8,3%	35,5%

N - 112, MI - micro, M - small, Ś - medium.

Source: own study.

The analysis showed that the most frequently mentioned benefit (Table 3) was the integration of processes in a social enterprise - 64.3% of the total indicated the answer "a significant factor". The next highest rated benefits (significant factor) were the impact of building closer relationships with customers and better adaptation to market requirements. Both benefits were received by 57.1% of all respondents, followed by increased competitiveness - 55.4% of the total. Looking at the detailed results, it can be noted that for micro-entrepreneurs the greatest benefit is increased employee productivity (58.3% of responses are: definitely important), followed by better adaptation to market requirements (83.3% of responses are: significant). For small companies, the main benefit of using 4.0 technology is increased competitiveness (75% of responses are: significant). and integration of processes in the enterprise (66.7% of responses are: significant). In the case of medium-sized

companies, the greatest benefit is the integration of processes in the enterprise (64.5% of responses are: significant), followed by better adaptation to market requirements (60.5% of responses are: significant).

According to all entrepreneurs, unclear economic benefits from investing in digital technologies are the greatest factor hindering the transformation process (57.1% of responses are: significant), the second most important factor is insufficiently qualified staff (50.9% of responses: significant).

Table 4.
Factors inhibiting the transformation process

Analysis area	Categoryies	N	%	MI	M	Ś	MI%	M%	Ś%
high financial investment requirements	I have no opinion	16	14,3%	1	2	13	8,3%	8,3%	17,1%
	definitely insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	insignificant	3	2,7%	0	2	1	0,0%	8,3%	1,3%
	significant	54	48,2%	3	11	40	25,0%	45,8%	52,6%
	definitely significant	39	34,8%	9	9	21	75,0%	37,5%	27,6%
insufficiently qualified staff	I have no opinion	9	8,0%	1	2	6	8,3%	8,3%	7,9%
	definitely insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	significant	57	50,9%	4	13	40	33,3%	54,2%	52,6%
	definitely significant	46	41,1%	7	9	30	58,3%	37,5%	39,5%
lack of support from management	I have no opinion	26	23,2%	1	6	19	8,3%	25,0%	25,0%
	definitely insignificant	1	0,9%	0	1	0	0,0%	4,2%	0,0%
	insignificant	8	7,1%	4	4	0	33,3%	16,7%	0,0%
	significant	49	43,8%	5	8	36	41,7	33,3%	47,4%
	definitely significant	28	25,0%	2	5	21	16,7	20,8%	27,6%
unclear economic benefits from investing in digital technologies	I have no opinion	22	19,6%	5	8	9	41,7%	33,3%	11,8%
	definitely insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	insignificant	7	6,3%	2	0	5	16,7%	0,0%	6,6%
	significant	64	57,1%	4	14	46	33,3%	58,3%	60,5%
	definitely significant	20	17,9%	2	2	16	16,7%	8,3%	21,1%
lack of digital standards, norms and certification	I have no opinion	30	26,8%	6	5	19	50,0%	20,8%	25,0%
	definitely insignificant	1	0,9%	1	0	0	8,3%	0,0	0,0%
	insignificant	4	3,6%	2	1	1	16,7%	4,2	1,3%
	significant	48	42,9%	3	8	37	25,0%	33,3	48,7%
	definitely significant	26	23,2%	0	7	19	0,0%	29,2%	25,0%
concerns around losing control over the company's intellectual property	I have no opinion	24	21,4%	2	6	16	16,7%	25,0%	21,1%
	definitely insignificant	0	0,0%	0	0	0	0,0%	0,0%	0,0%
	insignificant	10	8,9%	1	0	9	8,3%	0,0%	11,8%
	significant	52	46,4%	7	13	32	58,3%	54,2%	42,1%
	definitely significant	26	23,2%	2	5	19	16,7%	20,8%	25,0%
lack of digital knowledge and training	I have no opinion	27	24,1%	4	4	19	33,3%	16,7%	25,0%
	definitely insignificant	4	3,6%	1	0	3	8,3%	0,0%	3,9%
	insignificant	10	8,9%	1	0	9	8,3%	0,0%	11,8%
	significant	47	42,0%	5	13	29	41,7%	54,2%	38,2%
	definitely significant	25	22,3%	2	7	16	16,7%	29,2%	21,1%
unresolved issues around data security and data privacy	I have no opinion	28	25,0%	4	9	15	33,3%	37,5%	19,7%
	definitely insignificant	1	0,9%	1	0	0	8,3%	0,0%	0,0%
	significant	12	10,7%	1	0	11	8,3%	0,0%	14,5%
	significant	45	40,2%	4	10	31	33,3%	41,7%	40,8%
	definitely significant	26	23,2%	2	5	19	16,7%	20,8%	25,0%

N - 112, MI - micro, M - small, Ś – medium.

Source: own study.

By making a detailed analysis, it can be noticed that the biggest barrier is:

- in the case of micro companies: insufficiently qualified staff (58.3% of responses are: definitely important) and concerns about the loss of control over the company's intellectual property (58.3% of responses are: significant),
- in the case of small companies: insufficiently unclear economic benefits of investing in digital technologies (58.3% of responses are: significant) and insufficiently qualified staff, concerns about the loss of control over the company's intellectual property, lack of digital knowledge and training (54.2% each of responses are: significant).
- in the case of medium-sized companies: unclear economic benefits from investing in digital technologies (58.3% of responses are: significant), high financial investment requirements, insufficiently qualified staff (52.6% of responses are: significant).

Based on the results obtained, it is possible to distinguish the perception of Industry 4.0 by the surveyed groups of enterprises (Figure 1).

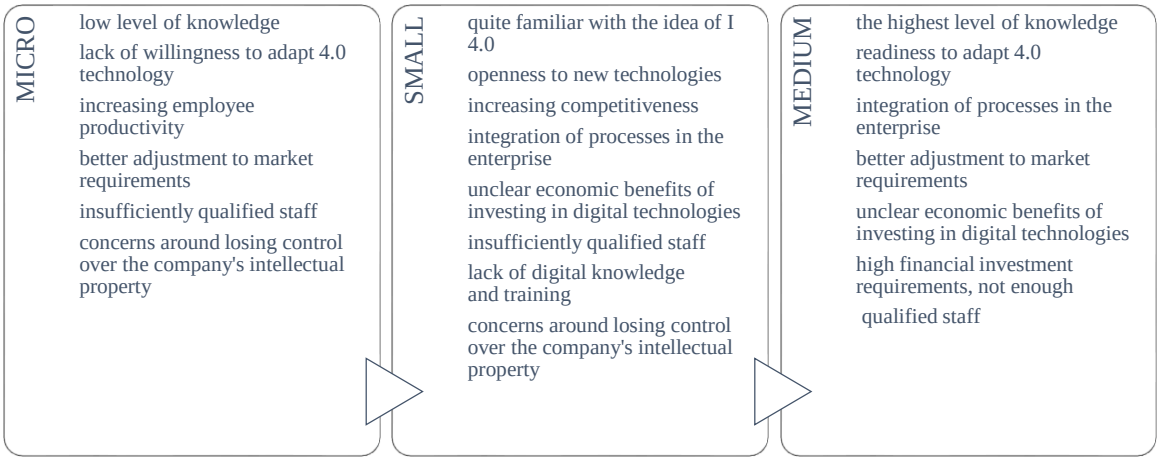

Figure 1. Perception of Industry 4.0.

Source: own study.

Based on Figure 1, it can be said that the larger the company, the better the perception of Industry 4.0, especially in terms of knowledge as well as willingness to make changes in this area. Also the question of benefits or limitations can be indicated that the larger the company, the greater the awareness of the positive as well as negative aspects associated with it.

Summary

Industry 4.0, also called the fourth industrial revolution, is based on the combination of traditional production processes with the latest digital technologies. As part of this production model, enterprises use advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), robotization, Big Data or computing cloud to improve production processes,

increase efficiency and optimize costs. Research shows that for small and medium-sized companies, Industry 4.0 is an opportunity to increase market competitiveness, increase employee productivity, better adapt to market requirements and integrate processes in the enterprise. However, many of these companies do not have adequate financial, technological or human resources to implement modern technologies on their own. For small and medium-sized companies, it is crucial to participate in training, workshops and conferences on Industry 4.0 to acquire the necessary knowledge and skills. Moreover, it is extremely important to build partnerships and cooperation with other companies, research institutions and scientific institutions to exchange experiences, jointly develop innovations and conquer new markets. Companies are increasingly realizing that investing in 4.0 technology brings real benefits and contributes to increasing efficiency, competitiveness and innovation. Therefore, more and more enterprises decide to modernize their processes and systems to adapt to the requirements of the modern market.

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