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Factors affecting Quality 4.0 implementation in Czech, Slovak and Polish organizations: Preliminary research

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ABSTRACT

With the proliferation of the Industry 4.0 paradigm, the inadequacy of conventional quality management tools has become increasingly apparent. The preliminary investigation presented in this paper focuses on the identification of the Quality 4.0 readiness level of organizations operating in the Czech Republic, Poland, and Slovakia, as well as affecting factors. The study is based on the review of relevant literature. The web-based questionnaire enabling organizations' representatives through Computer-Assisted Web Interviewing (CAWI) to take part in the study was used. Data from 298 completed responses were subjected to comprehensive analysis. Descriptive statistics and hypothesis testing were applied to analyse the data. Small and medium-sized organizations achieve low levels of Quality 4.0 readiness. Large organizations are better prepared. The study confirmed the dependence between the Quality 4.0 readiness level and whether the organization operates in automotive, while automotive organizations achieved a higher level of Quality 4.0 readiness than other organizations. The significant relationship between the Quality 4.0 readiness level and whether the organization has a certified management system was also confirmed. Received data also enabled the identification of the main barriers and benefits of Quality 4.0 implementation perceived by the organizations. The research findings identify the challenges that enterprises face regarding the Quality 4.0 implementation and the necessary support that organizations require. These findings can be a foundation for developing novel research initiatives and implementation programs. The research results contribute to the existing body of knowledge and bring new information and insights into the field of quality digitalization.

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1. Introduction

During the latter decades of the 20th century and the initial years of the 21st century, there was a notable acceleration in technological development, accompanied by increasingly rapid changes in the conditions under which organizations functioned. Moreover, the emergence of significant possibilities for integrating new, ground-breaking technologies prompted practitioners and researchers not to speak of evolution but of a fourth industrial revolution. Key technologies that distinguish Industry 4.0 (I4.0) include Autonomous Robots (AR), Systems Integration (SI), Internet of Things (IoT), Cloud Computing (CC), Augmented Reality (AR), Big Data (BD), and simulations [1, 2].

Quality 4.0 (Q4.0) is an emerging research topic dealing with the question: How Quality Management (QM) needs to be adopted in the digital era? The term 'Quality 4.0' has emerged as the result of integrating I4.0 features with traditional QM practices. Q4.0 brings benefits for

organizations like reduced costs of quality via reduced non-conformities and quality inspection, improved operational efficiencies, increased value proposition, transparent data-based partnership, and increased successful product and service innovations [3, 4]. There are only a few studies dealing with Q4.0 adoption in organizations, while most of them confirm a low level of Q4.0 readiness or maturity, e.g. [5-7]. The number of sources focusing on I4.0 readiness or maturity assessment is much higher and the problem is examined more in terms of the factors affecting the level of I4.0 maturity in organizations. Several I4.0 maturity models have been developed and applied [8-10]. Also, there are a few studies confirming differences in I4.0 readiness or maturity level depending on countries, e.g. [11, 12], size of the organization, e.g. [13-17], industry sector [18-20], etc. The problem of Q4.0 readiness level in organizations and factors contributing to the implementation of Q4.0 is little explored. Therefore, our paper focuses on the examination of Q4.0 readiness of organizations operating in the three Visegrad countries that belong among the most industrialized countries in the European Union – Poland, Czech Republic, and Slovakia. It examines factors that may relate to Q4.0 readiness level like organization size, industry sector, certified management systems in organizations and country of origin of organization These factors haven't been examined before in the context of Quality 4.0 readiness levels. It also focuses on the study of benefits and barriers of Q4. 0 implementation perceived by organizations. The research questions were defined as follows:

- What is the Q4.0 readiness of Czech, Polish and Slovak organizations?
- What are the main barriers and benefits of Q4.0 adoption perceived by organizations?
- Is there a significant relationship between organization size and Q4.0 readiness?
- Is there a significant relationship between Q4.0 readiness and whether the organizations have or don't have a certified quality management system (QMS)?
- Is there a significant relationship between Q4.0 readiness and whether organizations operate in the automotive industry or not?
- Is there a significant relationship between the country where organizations operate (Czech Republic, Poland, Slovakia) and Q4.0 readiness?

The findings of this study contribute to the existing body of knowledge by identifying Q4.0 readiness levels in organizations and affecting factors. The findings can help practitioners to understand the current state of transformation initiatives in this field and related aspects.

2. Literature background

2.1 Industry in Czech Republic, Poland and Slovakia and support of I4.0 on the level of countries

In the EU countries service sector employs most of the population. The Czech Republic, Slovakia and Poland are at the bottom of the ranking as far as employment in services is concerned. The countries belong among the six most industrialized economies in the EU. The Czech Republic is in second place after Ireland with the industry sharing 30.6 % of the Gross Domestic Product (GDP). The share of Poland is 29.8 % and the share in Slovakia is 28,6 % [21].

The most significant industry sector in the Czech Republic is the automotive industry with a 10 % share of GDP. Important manufacturers of passenger cars are Škoda Auto owned by the Volkswagen Group, Toyota, Peugeot Citroën Automobile and Hyundai. After the automotive, the chemical industry with a 7 % share of GDP followed by electrotechnics, machinery and metallurgy belong to the most important industry sectors. As in the Czech Republic, the automotive industry is the most important sector in Slovakia with a 13.9 % share of GDP. It accounts for 47 % of total industry production. Currently, four car makers are operating in Slovakia – VW, Stellantis, Kia, and Jaguar Land Rover. Slovakia is the world leader in car production per capita. Other high-value-added industries are the chemical industry (10 % share of the total industrial production), electronics and electrical components (9.3 % share of the total industry share), machinery, metallurgy and metal proceeding industry [22]. In comparison with the Czech Republic and Slovakia, Poland's reliance on the automotive industry is lower. It represents just 3.4 % of GDP [23]. Significant industry

sectors in Poland are the mechanical and electromechanical industry followed by the food industry, metallurgical and chemical industry [24].

Digital transformation is inevitable to maintain the countries' economic competitiveness. The latest results of the European Innovation Scoreboard show that the Czech Republic belong to the moderate innovator and Slovakia and Poland to the group of emerging innovators [25]. The Digital Economy and Society Index (DESI) ranked the Czech Republic in 19th place, Slovakia in 23rd and Poland in 24th place [26]. According to the World Digital Competitiveness ranking Czech Republic took 33rd place, Poland 46th and Slovakia 47th from a total of 64 countries [27]. The Czech Republic in comparison with Poland and Slovakia achieved the highest ranking on the base of the above-mentioned studies. According to the survey by the European Investment Bank, 79 % of firms in Slovakia use advanced digital technologies, 72 % in the Czech Republic and 66 % in Poland while the EU average is 69 %. As the industrial sector is important for the economy of the countries, there is an interest in supporting digital transformation. Strategic initiatives like the National Industry 4.0 Initiative in the Czech Republic (2015) and the Concept of Smart Industry in Slovakia (2016) were approved. In Poland, no Industry 4.0 individual strategic document was developed but the Future Industry Platform was established in 2019 as a part of the Responsible Development Plan to create mechanisms for cooperation and interdisciplinary knowledge transfer for accelerating digital transformation. National Industry 4.0 platforms were founded also in Slovakia (Smart Industry Platform) and the Czech Republic (National Centre for Industry 4.0). There have been established several Digital Innovation Hubs (DIHs) and European Digital Innovation Hubs (EDIHs) in the countries. Digital transformation of industries is also supported by cross-sectional strategies supplementing the above-mentioned initiatives like Digital Czech Republic (2018), the Digital Transformation Strategy of the Slovak Republic (2018) and Poland's Strategy of Responsible Development (2017) incorporating Industry 4.0 problematic.

2.2 Quality 4.0 and Quality 4.0 maturity and readiness models

Q4.0 is a relatively new term that has emerged in relation to I4.0. The field of Quality Management is essential for ensuring the required quality of products and services and customer satisfaction. Approaches to quality have gone through several development stages from Quality Inspection through Quality Control, Quality Assurance to Total Quality Management and now the era of I4.0 is forcing the development of the existing approaches towards Q4.0. Q4.0 as an emerging concept representing the next developmental stage of QM has attracted much attention from scholars, practitioners as well as consulting organizations (e.g. BCG, The Oakland Group, Juran Institute) during the last years. After the review of papers in the Web of Science (WoS) database containing the term Q4.0 in the title or abstract, 98 publications were found, while 15 of them were eliminated as they did not relate to the Q4.0 as well as the other 5 papers, that mentioned Q4.0 only by few words and the presented studies dealt with another area. The focus of the remaining 78 publications published from 2016 to 2023 is presented in Table 1.

Table 1 Focus of Q4.0 publications indexed in the WoS database

Publications No.	Focus
22	Q4.0 definition, and/or Q4.0 principles and characteristics and/or Q4.O advantages, disadvantages
20	Selected Q4.0 tools (implementations or review of selected tools and discussion)
14	Q4.0 maturity or readiness assessment or assessment of usage level of Q4.0 technologies
11	Identification of main determinants, dimensions of Q4.0 and Q4.0 framework development
5	Q4.0 competencies and/or relation between Q4.0 and human factor or Leadership's impact on Q4.0 implementation
3	Lean approaches in connection with Q4.0
2	Q4.0 in relation to sustainability or circular economy
1	Q4.0 impact on organizational performance

Q4.0 as a term was described in several publications, however, a uniform definition has not been established so far. According to the American Association for Quality, Q4.0 references organizational excellence within the context of I4.0 [28]. Q4.0 aligns quality management with I4.0, which results in increased efficiency, performance and improved business models. Q4.0 uses new technologies like BD, IoT and AI with existing quality methods to broaden the scope of QM and deal with a completely new set of complex problems. Some other examples of Q4.0 tools and methods include digital twin technology, which enables the creation of virtual models of products and processes, enabling simulation and optimization as well as blockchain technology, which allows secure and transparent tracking of supply chains and product histories. Using advanced technologies helps to design, operate and maintain predictive, adaptive, automated quality systems along with improved human interaction through quality planning, assurance and improvement to achieve new optimums in performance, operational excellence, and innovation. Q4.0 emphasizes the integration of QM to ensure a holistic approach to quality throughout the entire value chain. Researchers endeavour to define Q4.0 by highlighting its distinctive features. They note that this is a concept that promotes the adoption of contemporary QM methods, which are grounded, among other things in:

- customer value co-creation enabled by vertical and horizontal integration,
- cross-functional collaboration,
- eliminated visual and manual inspection,
- human empowerment and human-robot interaction,
- integration of the organisation's physical infrastructure and processes with the network and databases,
- collecting and analysing live data on the functioning of the infrastructure and processes,
- fast, adaptive learning and introducing changes before problems occur (prediction),
- using ML and AI for monitoring, analysis, and fast decision-making,
- improved trust, transparency, and auditability.

There are a few Q4.0 readiness or maturity models that have been published so far. Table 2 presents these models while elements of individual models were assigned to the selected areas – governance and culture, processes, people, technology, and results. Many of the dimensions defined by the models and related elements overlap but they are named differently. For that reason, the elements related to the dimensions of the models were assigned to the above-mentioned areas. The Q4.0 model published by LSN involving 11 elements was the first published framework in this field. It helps to interpret the organization's current state and identify what changes need to be done to move towards Q4.0. The transformational levels are defined for every element. In other cases of Q4.0 maturity models the area of Process often involves elements that cover Q 4.0 technologies used for process control. The three readiness models in Table 2 define the prerequisites for Quality 4.0 and focus mainly on the first three areas. The model published by [29, 30] defines the certified QMS as a prerequisite for successful Q4.0 implementation.

Among the challenges related to Q4.0 in terms of its implementation, management commitment to invest in technology and missing Industry 4.0 strategy of the organization were identified as the most important [5]. The study conducted by [36] among the top challenges identified the high cost of implementation, lack of resources, lack of knowledge, organization culture and not clear competitive advantage offered by Q4.0. The motivation factors for Q4.0 implementation involved accessibility of information, BD-driven QM programs, increased customer satisfaction, productivity improvement and cost saving [37, 38].

The number of studies dealing with the factors related to I4.0 maturity or readiness level is much higher. Several studies confirmed the relationship between Industry 4.0 maturity level and size of the organization [13-17] and industry sectors [18-20], while among the most matured sectors were the automotive, electronics and pharmaceutical industries.

In our study, we focused on the examination of selected factors in relation to the Q4.0 readiness levels as well as motivators driving Q4.0 implementation in organizations and main barriers avoiding the digital transformation of the traditional approaches to quality.

Table 2 Q4.0 publications focus in the WoS database

Q4.0 Maturity/Readiness Model	No. of items within the areas					Sum of Elements (∑)	Maturity/ Readiness level
	Governance, culture	Processes	People	Technology	Results		
Q4.0 Transformation Model [32]	2	3	2	4	-	11	Levels for each element
Q4.0 Maturity Model [7]	4	4	5	9	-	22	7 Q4.0 maturity levels
Q4.0 Maturity Index [33]	4	12	4	8	-	28	5 Q4.0 maturity levels
Q Intelligence Maturity Model [34]	1	4	-	2	1	8	5 Stages of Q maturity ladder
Q Intelligence Maturity Index [35]	2	8	1	2	1	14	4 Q intelligence maturity stages
Q4.0 Readiness Assessment Tool [31]	16	6	3	-	-	25	5 Q4.0 readiness levels
Q4.0 Readiness Assessment Tool [36]	4	2	2	-	-	8	5 Q4.0 readiness levels
Q4.0 Readiness Assessment Tool [6]	5	2	3	2	-	12	5 Q4.0 readiness levels

3. Methodology

Conducting preliminary research is essential to establish familiarity with the phenomenon under study, determine the importance and intensity of its features, and identify factors that may significantly impact the research outcome. This preliminary research serves as a foundation for obtaining valuable initial knowledge about the subject of investigation and concurrently highlights areas that require further exploration and development. Preliminary research can be carried out using formalized and structured methods and unstructured methods with a low level of formalization. To achieve the goals of the study, quantitative methods were used. For data collection online questionnaire was developed with closed multiple-choice questions. The questionnaire contained items focusing on:

- segmentation characteristics of organizations (size, industry type),
- types of implemented management systems in organizations,
- benefits and barriers of Q4.0 implementation perceived by respondents,
- Q4.0 readiness level in organizations.

The questionnaires were distributed through a dedicated internet portal (CAWI) to organizations of different sizes and sectors operating in the Czech Republic, Poland and Slovakia. Additionally, information about the study was disseminated through professional social networking sites. Data collection was carried out between April and July 2022. The questionnaires were filled out by quality managers or integrated management system representatives of the organizations.

Descriptive statistics and hypothesis testing were used to evaluate the data collected through the questionnaires. For hypothesis testing the Chi-square test was used, while the following hypotheses were proposed:

- H1: There is a dependence between the Quality 4.0 readiness level and the size of the organization.
- H2: There is a dependence between the Quality 4.0 readiness level and whether the organisation operates in the automotive industry.
- H3: There is a dependence between the Q4.0 readiness level and the country in which the organization operates.
- H4: There is a dependence between the level of Q4.0 readiness and whether the organisation has a certified quality management system or doesn't have.

The null hypothesis H0 acceptance and rejection of alternative hypothesis H1 in the case of the above-mentioned hypotheses confirms the significant dependence between the examined parameters. Otherwise, it confirms that there isn't a significant relationship between the parameters. For evaluation of Quality, 4.0 readiness 6 levels were used:

- Level 0 – the organization is not prepared for Q4.0 at all.
- Level 1 – information and automation technologies are used isolated without mutual connection.
- Level 2 – information systems and infrastructure elements are connected to the network but without the possibility of control of processes in real-time.
- Level 3 – digitalization enables real-time control of processes and communication.
- Level 4 – big data from internal processes and external processes are analysed to predict future state.
- Level 5 – decisions are realized automatically through intelligent systems that are widely used in organizations.

On the base of the literature review, we assumed that a significant proportion of the surveyed organizations are likely to be in the early stages of implementing the Quality 4.0 concept. Completed implementation projects in the Quality 4.0 domain are relatively scarce among organizations. Nevertheless, there is a growing interest among organizations in this area. Evaluating the actual level of preparedness, perceived benefits, and obstacles and the relation of the selected factors with the level of Q4.0 readiness will contribute to the existing body of knowledge and provide valuable information for practitioners.

4. Results and discussion

4.1 Research sample

Totally 298 questionnaires were received, 121 in the Czech Republic, 101 in Poland and 76 in Slovakia. The received questionnaires represented over 20 industry sectors. The most represented industries were the automotive industry (27 %), mechanical industry (16 %) chemical industry and plastics processing (12 %). The structure of respondents by industry sector is presented in Fig. 1.

Medium and large organizations dominated the study. Specifically, 20 % of the respondents represented organizations with over 1,000 employees. Meanwhile, 29 % of the respondents were from large organizations, and 34 % were from medium-sized organizations. The breakdown of participating organizations according to their size in terms of the number of employees is shown in Fig. 2.

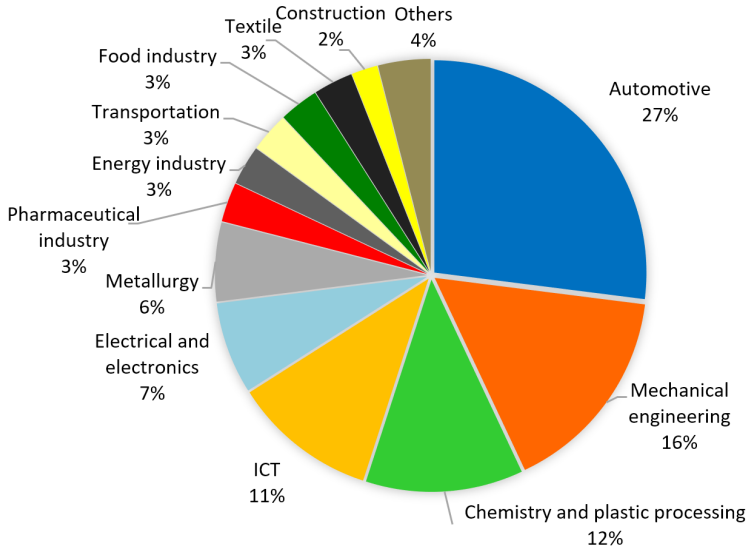

Fig. 1 Organizations by industry sector

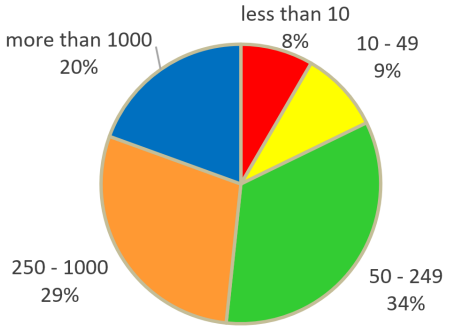

Fig. 2 Organizations according to the number of employees

According to the results, 54 % of the respondents reported that their organization have a certified ISO 9001 QMS, while 30 % indicated an integrated management system (IMS) involving environmental or occupational health and safety management system. As many as 7 % of respondents declared the implementation of the ISO 13485 system and 29 % of IATF 16949. Additionally, 19 % of respondents declared implementation and certification of at least one MS and 17 % of organizations didn't have any certified management system. Fig. 3 illustrates the percentage of organizations with individual management systems. The respondents could choose more options.

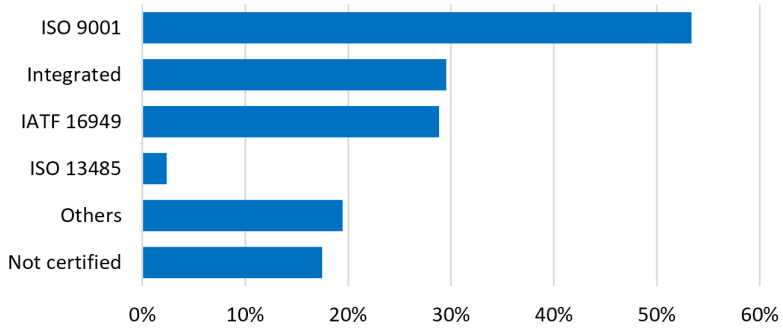

Fig. 3 Implemented management systems in organizations

4.2 Potential benefits and barriers of Q 4.0 implementation

Respondents were questioned about their perception of the main benefits offered by Q4.0 implementation while multiple responses were offered. The results are presented in Fig. 4.

The three most important benefits listed by the respondents were the creation of conditions for long-term ability to succeed in a competitive environment (52 %), support of interconnection of processes and levels of management (48 %), performance increase of all processes (44 %). Organizations with an IMS or IATF 16949 consider support of interconnection of processes more often as a significant benefit than those with only ISO 9001 or without these systems. The benefit of competitive advantage was confirmed by organizations with ISO 9001 or IATF (64 % and 73 %). Mass customisation of products (12 %) and the possibility of achieving compliance at the 6-sigma level (12 %) are considered the least significant benefits of Q4.0 implementation. Almost 67 % of very large organizations consider achieving the 6 Sigma level as a benefit, and 59 % the increased flexibility of interventions in case of product deviations and process specifications.

The most significant barriers of Q4.0 implementation perceived by the respondents are shown in Fig. 5.

Time and investment requirements are the most significant barriers considered by 70 % of organizations, followed by the current lack of financial resources (35 %) and the absence of a long-term QM strategy. Organisations without certificated management systems more often emphasised the need to supplement knowledge (39 %) as a barrier of Q4.0 implementation than those with certified management systems.

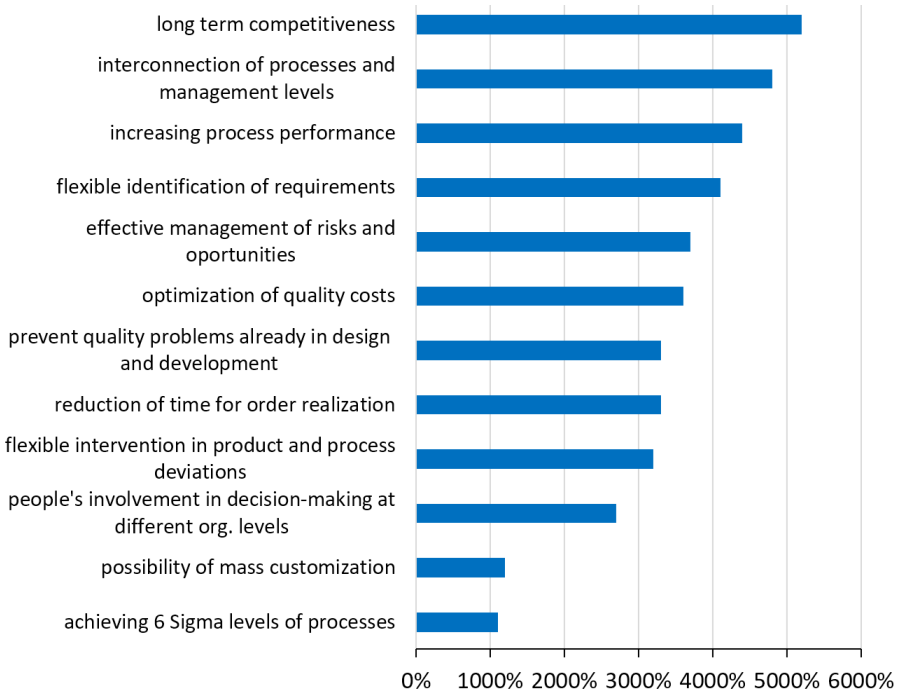

Fig. 4 Potential benefits of Q4.0 implementation

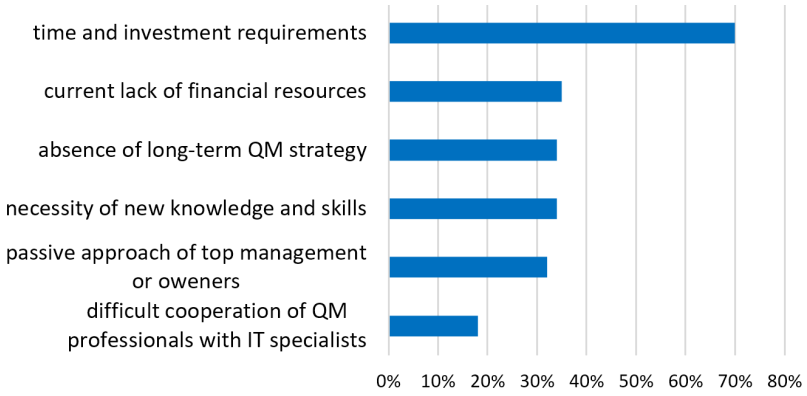

Fig. 5 Potential barriers of Q4.0 implementation

4.3 Quality 4.0 readiness level

Almost 22 % of respondents stated that their organization is not ready to implement Q4.0 (level M0). Level M1 characterized by isolated automation and information systems was chosen by 15 % of organizations. The level M2 representing partially interconnected information systems was typical for 16 % of organizations. Level M3 described by connected information systems and infrastructure without the possibility of process control in real-time is achieved by 12 % of organizations. Level M4 achieved the second highest value (20 %) and represents organizations where digitalization enables the control of processes in real-time. There is a low percentage of organizations achieving level M5 (10 %) where advanced analytics is used for proceeding the big data to make predictions and the highest level M6 characterized by the possibility of automated decision-making enabled by intelligent technologies based on big data and advanced analytics is typical for 6.5 % of organizations. Fig. 6 shows the percentage value of the organization classified into individual Q4.0 readiness levels.

In micro and small organizations prevail the M0 and M1 levels. In the case of medium-sized organizations, the Q4.0 readiness level rises, but only 27 % of organizations achieve M4, M5 or M6 levels. More than 40 % of large organizations achieve the three highest levels and in the case of very large organizations, it is more than 60 % of organizations.

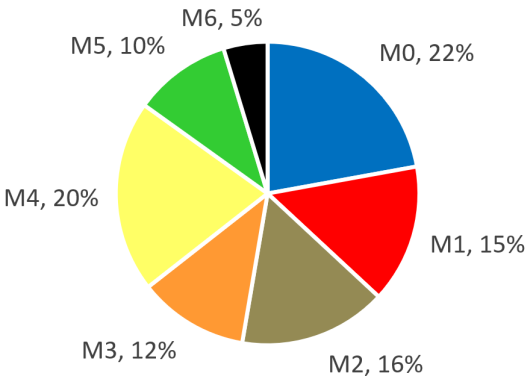

Fig. 6 Quality 4.0 readi ness levels

Fig. 7 shows the percentage of organizations of different sizes within individual Q4.0 readiness levels.

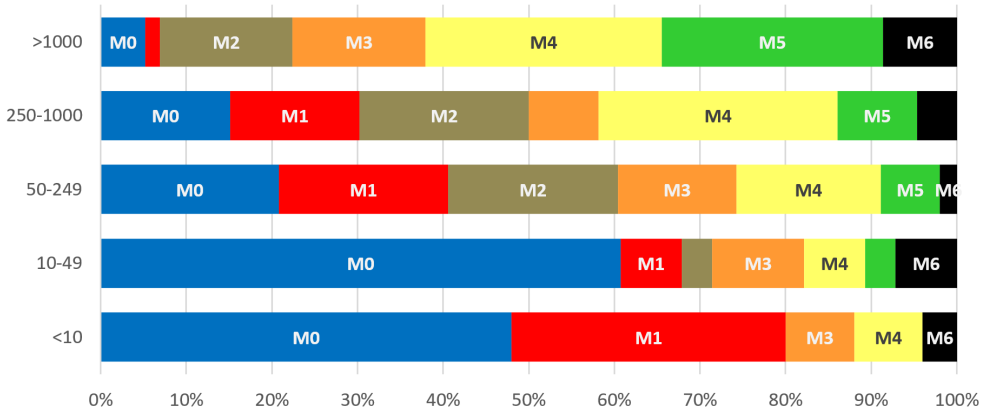

Fig. 7 Quality 4.0 readiness levels in the organizations with different numbers of employees

4.4 Hypotheses testing

From the results in Fig. 7 it can be concluded that the level of readiness for Q.4 implementation is related to the size of the organisations. The results of the H1 testing (p-value = 0.000) confirm that there is a significant statistical dependence between the level of organizational readiness to implement Q4.0 and the size of the organization. The test used does not allow to define what is the cause and the effect, however, in the context of Fig. 7 it can be concluded that large organisations are better prepared for Q.4 implementation than small and medium organizations. The fact that I4.0 maturity and readiness levels are higher in large organizations than small and medium-sized was confirmed in some studies, e.g. [13-17].

The results of the hypothesis H2 testing (p-value = 0.002) show that there is a significant statistical dependence between the level of readiness for Q4.0 implementation and whether the organisation operate in the automotive industry. The organisations operating in the automotive industry have a higher level of Q4.0 readiness (average level is 4.221, i.e. readiness level between M3 and M4) than organisations from other sectors (average level is 2.795, i.e. readiness level between M1 and M2). This is in accordance with the percentages, where the results show that 54 % of non-automotive organisations ranked themselves to be at the Q4.0 readiness levels M0 and M1. In contrast, only 14 % of organisations from the automotive sector ranked themselves to be at the first two lowest readiness levels and 53.5 % of organisations ranked themselves to be at the highest levels M4 to M6. Some studies focusing on the Industry 4.0 readiness and maturity confirmed that automotive sector belongs to front runners, e.g. [18-20]. It is consistent with our finding.

On the basis of the results of the hypothesis H3 testing (p-value 0.001), it is possible to accept the null hypothesis and reject the alternative hypothesis, what means that there is a significant dependence between the country where the organization operates and the Quality 4.0 readiness level. This finding may be related to the different industry structures in the countries. In the Czech

Republic and Slovakia, in contrast to Poland, the automotive industry is predominant, where there are higher levels of Q4.0 readiness. It also can relate to different levels of digitalization in the countries confirmed by the studies like, e.g. [25-27].

Based on the H4 hypothesis testing (p-value = 0.002), it was concluded that there is a significant statistical dependence between the level of Q4.0 readiness level and whether the organisation has a certified QMS or doesn't have. It can be concluded that organisations with a certified QMS are better prepared for the implementation of Q4.0 (average level is 3.403, i.e. readiness levels between M2 and M3) than organisations without a certified QMS (average level is 2.736, i.e. readiness levels between M1 and M2). Again, the percentage share showed an interesting result. The lowest level of readiness was in the case of 49.1 % of organisations that do not have a certified QMS. Only 18.2 % of organizations with a certified QMS evaluated themselves to be at the M0 level.

5. Conclusion

Organizations that apply I4.0 technologies are experiencing technological advancements that reveal the limitations of current quality management tools. Implementation of advanced information technology systems equips quality experts with sophisticated data, necessitating their adept interpretation. Consequently, novel and updated quality tools must be developed, and new competencies must be defined and guaranteed.

During our preliminary research we focused on the Quality 4.0 readiness level of organizations operating in the selected Visegrad countries – Poland, Czech Republic and Slovakia. The results revealed that small and medium-sized organizations achieve low levels of Quality 4.0 readiness. Large organizations are better prepared. There are only a few studies focusing on Quality 4.0 readiness level that have been published confirming that organizations are in the early stages, what is consistent with our findings in terms of small and medium sized organizations (SMEs). Our results confirmed statistically significant dependence between the size of the organization and Quality 4.0 readiness. It was also confirmed the dependence between Quality 4.0 readiness and whether the organization operates in automotive or not. Automotive organizations achieved a higher level of Industry 4.0 readiness. Among the three main barriers of Quality 4.0 implementation perceived by organizations the investment requirements, the current lack of financial resources and the absence of a long-term QM strategy were identified. On the other hands, the organizations consider as three main benefits of Quality 4.0 implementation the long-term competitiveness, interconnection of processes and organization levels and increasing process performance. The study confirmed the dependence between Quality 4.0 readiness and the countries where the organizations operate. Organizations with certified (QMS) achieved higher levels of Q4.0 readiness and it was confirmed that there is a statistically significant dependence between Q4.0 readiness and whether the organization has implemented certified QMS.

Q4.0 is a recently developed concept and research in this area is in its early stages. The research findings identify the challenges that enterprises face regarding the Quality 4.0 implementation and the necessary support that they require. These findings can be a foundation for developing novel research initiatives and implementation programs. They can serve as an input for preparation of supporting initiatives for SMEs on the level of countries. The research results contribute to the existing body of knowledge and bring new information and insights into the field of quality digitalization and factors contributing to the transformation of traditional quality approaches for the needs of Industry 4.0 and can help organization to build suitable strategies The research conducted in this study is preliminary. A limitation of the study is the questionnaire's length. The examined factor - country of organization's origin in relation to Quality 4.0 readiness level must be further analysed. Also not all possible factors and dependencies were detected. However, these limitations can be addressed in future, more in-depth research.

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