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MATURITY OF THE QUALITY MANAGEMENT SYSTEM AND DEALING WITH CRISIS SITUATIONS

Abstract: *The aim of this article was to analyze how organizations with an implemented ISO 9001 quality system responded to the crisis caused by the Covid-19 pandemic. For the purpose of the study, a set of questions was developed to enable a simplified assessment of the QMS maturity level. Next, it was verified how organizations with different levels of quality culture coped with the reorganization forced by the restrictions associated with the outbreak of the pandemic. As a result, it was confirmed that there is a relationship between QMS maturity and the implementation of actions that can be described as systemic. It was also found that the involvement of top management and the motivating and supporting role of the quality management representative were the factors that had the greatest impact on taking action in a crisis situation.*

Keywords: *quality management system, pro-quality culture, restrictions, crisis.*

1. Introduction

Quality management system (QMS) is planned and established by documenting procedures for the processes of organization to fulfill the needs and expectations of internal and end customers. The international standard, ISO 9001, specifies the requirements of quality management system (QMS) to consistently provide products that meet customer and applicable statutory and regulatory requirements (Natarajan, 2017). It provides a framework for organizations to establish, implement, maintain and continually improve their quality management system. By implementing ISO 9001, organizations can improve their processes, reduce errors, increase efficiency, and ultimately enhance customer satisfaction (*ISO - ISO 9001 and related standards - Quality management*, 2021). However, in contemporary times, it appears that one of the most significant advantages of

implementing a quality management system is the necessity to review organizations from a new, pro-quality perspective.

Effective and efficient quality management, resulting in a high level of product quality, requires the development of a specific organizational culture with a pro-quality character, referred to in literature as a culture of quality (Gołębiowski, 2014). Quality culture encompasses everything that employees possess, think, and do as members of an organization to ensure that the product (or service) meets the needs or expectations of customers that have been established, conventionally accepted, or mandatory (Bugdol, 2018). The notion of quality culture is understood as comprising shared values, beliefs, expectations and commitments toward quality that are supported by structural and managerial elements and processes that enhance quality (Rapp, 2011). Quality culture can also be understood as a set of values, policies,

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behaviors, and decision-making in which there is positive, visible, and shared commitment to quality, with an emphasis on continuous improvement (Wiśniewska & Grudowski, 2022). It also involves the development and implementation of organizational improvement strategies, the use of information for continuous improvement, the correlation between competencies and quality responsibility, collaboration in achieving company goals, and reward systems that take into account work outcomes (Skrzypek et al., 2019). The condition for shaping a culture of quality is a change in the management model from traditional, highly hierarchical and functional to an approach characterized by an active attitude of employees and employee responsibility in the organization's management process (Karaszewski, 1999).

When referring to organizations that have implemented the ISO 9001 system, the concept related to a pro-quality culture of management is the maturity of the quality management system. The maturity of a quality management system refers to its level of development and effectiveness in meeting the organization's quality objectives.

The level of maturity of quality management system is a crucial factor, along with the organizational culture and professional involvement. The QMS maturity signifies how the organization creates and executes the system, evaluates the processes and outcomes, and most importantly, utilizes it as a foundation for ongoing enhancement (Prasnati & Wardhani, 2020). The QMS maturity can be measured quantitatively, in such context it is related to a time dimension, indicating a more advanced state over the years (Sousa & Voss, 2001). However, it is also closely linked to best practices of quality management and can be measured by customer-perceived quality, as well as the effectiveness and efficiency of process management (Nascimento et al. 2016). Therefore, it can be said that QMS maturity refers to the depth of the organization's experience with quality management system

(Novokmet & Rogośić, 2017). A level of maturity is a valuable tool in identifying areas of improvement. This knowledge can be used to fill gaps and ultimately support organizations in reaching strategic and operational objectives (Vanalle et al., 2016).

There are many models for measuring the QMS maturity, most of which are based on self-assessment by the organization. These models are usually related to quality management tools and are linked to models of excellence and quality awards. The three most commonly used models for assessing the level of maturity and functioning of quality management systems are: the SO 9004 standard, the EFQM Model, and the guidelines of the ISO 10014 standard. (Wolniak, 2011). A literature review shows that researchers also create their own maturity assessment models, either by combining existing approaches or developing their own tools. Nascimento et al. (2016) developed a maturity model for quality management systems with 5 levels by combining other recognized maturity models, namely Crosby Maturity Grid, PNQ Quality Award, and JIS Q 9005 standard. Grabowska & Takala (2018) combined QMS maturity with quality costs and proposed a technique for assessing QMS maturity, where QMS maturity is the variable and quality costs are the output measure. Wolniak (2019) developed their own tool to measure the level of QMS maturity, based on the requirements of the ISO 9001 standard modified using the expert method. Xiaofen (2013) proposed a tool based on Crosby's Evaluation Model of Quality Management Maturity, ISO 9004 and criteria for performance excellence of Baldrige National Quality Program. On the other hand, Odważny et al. (2019) developed their own maturity model by building upon the ISO 9004 standard and adding KPI proposals for tracking and measuring individual activities.

All above models, both basic and modified by researchers to achieve specific research goals, enable the measurement of QMS

maturity. Their undeniable advantage is comprehensiveness and the possibility of precisely determining the level of maturity. On the other hand, the research process is usually long and demanding for organizations, which limits the possibilities of its use.

Particularly unexpected and crisis situations make it difficult, and sometimes even impossible, to conduct comprehensive research. Such a situation was the outbreak of the Covid-19 pandemic, which forced drastic changes in organizations. On the one hand, this situation provided extremely instructive observations for researchers, but on the other hand, the possibility of conducting research in organizations struggling with the crisis was significantly limited. Therefore, in the current study, a simplified questionnaire was chosen, containing 10 variables determining the QMS maturity, determined by an expert method. This was aimed at reducing the time that respondents had to dedicate to participating in the study, but above all, to ask during survey a wide range of questions about the phenomena that occurred in organizations during the pandemic.

The aim of this article is to present and analyze data on how organizations with an implemented ISO 9001 quality system responded to the crisis of the Covid-19 pandemic. Providing international best practice, ISO standards are designed to help organizations build their resilience, improve their processes and achieve greater efficiencies. Therefore, organizations with a higher level of QMS maturity should be better able to cope with crisis situations - verifying this relationship was the main idea of this article.

2. Materials and methods

The data analyzed in this article is a part of a project aimed at analyzing the behaviors of pro-quality managed organizations in the face of the Covid-19 pandemic crisis (Kafel,

2021). The aim of the project was to diagnose the organizational behaviors of companies with an implemented quality management system compliant with the ISO 9001 standard. Particular emphasis was placed on the functioning of the quality management system in case of a sudden crisis, with special consideration given to the possibility of transitioning to remote work. Organizations that met the following criteria were selected for the study: (1) at least some employees worked remotely in 2020, (2) organizations had implemented and certified a management system compliant with ISO 9001. The database developed for the study contained data from 1200 companies with a certified quality management system. Additionally, PF ISO 9000, the association of organizations with an implemented quality management system supported the survey by providing a link to the CAWI survey to members of the association. So, several certification bodies have agreed to send emails containing a survey link and a letter of recommendation to the companies they are in contact with.

The survey started in January 2021, after a pilot study, it was conducted using the CATI technique. Due to a large number of refusals resulting from respondents' lack of time and low effectiveness of telephone contacts, a mix-mode technique was included in the survey. In some cases, representatives of companies informed interviewers that contact with decision-makers was possible only by email. In such situations, CAWI surveys were sent by email using research agency software. In the final stage of the survey, a single system reminder email was sent to encourage organizations to complete the online survey and telephone interviewers contacted those companies that had previously expressed a desire to participate in the survey but had delayed completing it.

As a result, 205 organizations participated in the survey, which is 17.1% of the target group. Characteristics of the participants are presented (Table 1).

Table 1. Characteristics of participants (own elaboration)

Variable (N=205)	Frequency (%)
Number of employees	
up to 9	7,30%
10-49	22,00%
50-249	37,60%
more than 249	33,20%
Annual income (PLN)	
less than 2 mln	15,60%
above 2 to 10 mln	13,70%
above 10 to 50 mln	14,60%
1% more than 50 mln	8,30%
no response	47,80%
Scale of the operations	
local / regional	17,10%
all-Poland	28,80%
international	53,20%

The research form consisted of 5 parts focusing on various aspects related to the quality management in enterprises during the pandemic. The complete questionnaire consisted of 32 closed-ended questions and 11 open-ended questions. The closed-ended questions mainly used a 5-point Likert scale, a dichotomous scale with the option to add comments, and a dropdown list. Additionally, custom scales were created for some sections of the survey.

This article presents a part of the project aimed at investigating the impact of a pro-quality management culture on how organizations respond to crises. This part of the questionnaire contained two sections with different response scales. The first section focused on the functioning of the quality management system before the outbreak of the pandemic. Respondents evaluated the degree of implementation of listed activities influencing the pro-quality culture on a 5-point Likert scale. The second section focused on the actions taken by the surveyed organizations in response to the

pandemic outbreak, using a dichotomous scale. Metric data characterizing the surveyed organizations were also used in the analysis.

Hierarchical clustering using Ward's linkage method and k-means clustering multivariate grouping technique were used to segment consumers. Kruskal-Wallis H test and Mann-Whitney U were used to identify statistically significant differences among the observed groups. Additionally, Spearman's correlation coefficient was used to identify relationships between the level of maturity and actions taken in response to pandemic restrictions. The data analysis was conducted using Statistica (ver. 13.3).

3. Results

3.1. Segmentation based on the degree of implementation of quality management system

The analysis was based on 10 items that are necessary for the proper functioning of the quality management system. The surveyed organizations performed the self-assessment, measured on a five-point Likert-type scale (where 1=strongly disagree and 5=strongly agree). The statements concerned the functioning of the quality management system before the pandemic and were as follows:

1. Employees showed commitment to actions carried out within the quality management system.
2. The system documentation was tailored to the company's needs.
3. Audits had a significant impact on improving the organization's functioning.
4. The document flow within the company was efficient.
5. There was an atmosphere in the organization that can be described as a "quality culture".

6. The quality management system positively influenced the development of a quality culture.
7. The top management was involved in activities related to the quality management system.
8. Company trainings were held regularly.
9. The QMS representative motivated employees to carry out improvement activities.
10. Employees always kept up to date with changes introduced in the company.

As a first step, hierarchical clustering with Ward’s linkage method was used to identify the number of clusters adequate to the purpose of the study. To determine the

optimal number of clusters, the dendrogram produced by the algorithm was analyzed. The level at which merging two clusters leads to a significant increase in the sum of squared distances were interpreted as the optimal number of clusters. The preliminary substantive analysis showed that the four-cluster solution was the most meaningful and interpretable.

Next, in order to segment the surveyed organizations based on degree of implementation of quality management system, the k-means clustering multivariate grouping technique was used, according to the number of clusters identified through the hierarchical clustering procedure. Figure 1 presents the results.

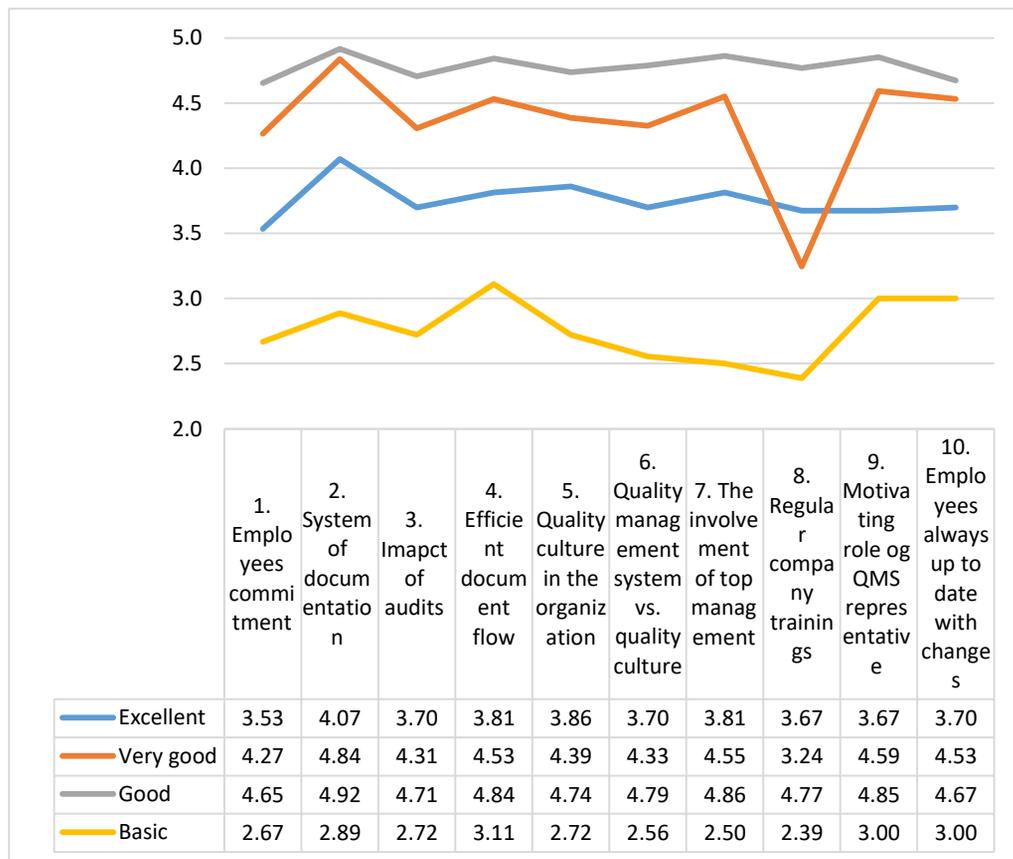


Figure 1. Segmentation of surveyed organization due to QMS maturity (own elaboration)

As a result of the segmentation procedure, organizations were identified in which the maturity (level of implementation) of the quality management system is: (1) excellent, (2) very good, (3) good and 4 (basic).

The “excellent” cluster is the largest, with 97 organizations (46.3%). The average scores for all 10 surveyed items were in the range of 4.7-4.9, which indicates the high maturity of the quality management system.

The second cluster includes 49 organizations (23.9%) and presents a slightly lower level of implementations of some components of the quality management system. The average result for most surveyed items (8 out of 10) is in the range of 4.3-4.6, while the method of conducting ISO system training was definitely rated low (3.2). On the other hand, the adequacy of system documentation was rated on average at 4.8, which means that organizations from a "very good" cluster have a very good basis for achieving a higher degree of quality management system maturity.

The third cluster, labeled as “good” consists of 44 organizations (21.0%) with average score for most surveyed items in the range 3.5-3.9. Only the adequacy of the system documentation to the needs of the organization was rated slightly higher. An average rating of just under 4.0 means that most of the components of the quality management system are implemented and maintained, but at the same time each item still has the potential for improvement.

The fourth cluster is the smallest, containing only 18 organizations (8.8%). Compared to the rest of the respondents, these organizations present the lowest degree of implementation of the quality management system, the average score for most of the surveyed items is 3 or less (2.4-3.1). The degree of maturity of the QMS can be described here as "basic", which means that the organization has implemented the requirements of quality management system, but the system has not yet been fully operational.

3.2. Factors affecting the maturity of the quality management system

The current study investigated the potential impact of five variables on the effectiveness of Quality Management Systems (QMS), namely company size, range of operations, annual income, and number of QMS recertification cycles. The objective was to determine whether these variables resulted in statistically significant differences between groups with varying levels of QMS maturity, which were categorized as excellent, very good, good, and basic.

The Kruskal-Wallis H test was employed to identify statistically significant differences among the observed groups, while the Mann-Whitney U test was used to determine between which groups statistically significant differences in mean values exist. Table 2 presents the results.

Table 2. Factors influencing QMS maturity – Kruskal Wallis test (own study)

	Clusters				Kruskall Wallis H	
	Excellent	Very good	Good	Basic		
Factors influencing QMS maturity	median obs.-median exp.				chi ²	Sig.
company size	-0,049	-1,146	0,683	0,512	0,158	0,984
range of operations	-2,780	1,805	0,976	--	3,375	0,337
annual income	-1,202	-2,495	3,936	-0,239	2,268	0,519
number of QMS recertification cycles	13,293	-3,659	-9,634	--	26,947	0,000

The Kruskal-Wallis H test enables the assessment of significant differences in mean values across multiple groups. Based on the findings presented in Table 3, it can be inferred that the mean values were not equal among the various clusters for only one variable, namely the number of QMS recertification cycles. However, statistical analysis indicates that the other three variables did not show significant differentiation among the identified clusters. In order to identify statistically significant differences between clusters, the Mann-Whitney U test with Bonferroni correction of alpha value was used. The findings indicate that there are no statistically significant differences between the "excellent" and "very good" clusters ($p = 0.945$), as well as between the "good" and "basic" clusters ($p = 0.727$). However, the number of QMS recertification cycles is a significant factor that distinguishes the remaining clusters at a

statistically significant level ($p = 0.000$).

3.3. Actions taken by organizations in response to crisis situation

The analysis was conducted using the case of the crisis represented by the Covid-19 pandemic. Actions that organizations had to implement to ensure continuity of their operations during a crisis were analyzed. Respondents answered 12 questions using a dichotomous scale (yes/no), with the option of adding comments.

In accordance with regulations implemented to prevent the spread of pandemics, organizations had been required to implement three critical measures to prevent the transmission of infectious diseases: distance, disinfection and masks (DDM). The table 3 provides an overview of action implemented by surveyed organization to deal with these restrictions.

Table 3. Action implemented by the organizations to deal with crisis situation (own elaboration)

Actions	Percentage of answers		
	Implemented	Not implemented	Existing before Pandemic
Implementation of mandatory sanitary restrictions (DDM)	94,6%	5,4%	--
Closure of access to social rooms and meeting rooms	94,6%	5,4%	--
Work schedule reorganization	74,6%	25,4%	--
Shift work and/or administrative staff duty shifts	89,8%	10,2%	--
Establishment of a crisis team	68,3%	29,8%	2,0%
Remote document circulation	55,1%	30,2%	14,6%
Partial or complete transition to remote audits	54,6%	45,4%	
Inclusion of remote work areas in the auditing system	21,5%	75,6%	2,9%
Organization of management meetings and employee meetings remotely	72,2%	27,8%	--
Remote staff training	84,9%	15,1%	--
Remote recruitment interviews	94,6%	5,4%	--
Remote contacts with contractors	98,5%	1,5%	--

All surveyed organizations implemented measures to ensure a sanitary regime (DDM). Notably, the vast majority of them (94.6%) also developed internal procedures for implementing sanitary recommendations. The majority of organizations approached this problem systematically, with 68.4% of them also establishing crisis teams (only 4 organizations had such teams prior to the outbreak of the pandemic).

Further actions taken by these organizations included the reorganization of internal activities to reduce the risk of virus spread and the transition to remote work. Approximately one quarter of the surveyed companies did not see the need for a change in work organization. The remaining organizations, comprising 74.6% of the survey, implemented changes such as shift work or dividing employees into smaller groups working in separate rooms without contact between workers from different groups. Additionally, they introduced or extended work breaks for ventilation and disinfection of premises, or organized breaks at different times to avoid contacts among employees. Almost all organizations (94.6%) restricted access to meeting places for employees, such as break rooms, employee kitchens, conference rooms, or meeting rooms. The majority (89.9%) also implemented a rotational work schedule or on-call duties for administrative personnel, frequently combined with partial or full transition to remote work.

As part of the transition to remote work, organizations also implemented online activities such as employee training (84.9%), board meetings and other employee group meetings (98.5%), meetings with contractors and stakeholders (98.5%), as well as interviews with job candidates (94.6%). Slightly over half of the respondents (54.6%) decided to conduct internal audits remotely, with an additional 21.5% incorporating newly established remote work areas into the auditing procedures. During the pandemic, remote document circulation was implemented in 69.8% of the surveyed

organizations, with 14.6% of organizations having established remote circulation procedures prior to the pandemic, and 55.1% introducing them as a response to the need for work reorganization caused by the pandemic.

To verify the factors that influenced the actions taken by organizations in response to the pandemic outbreak, the Spearman correlation coefficient was employed. The analysis considered factors that constitute QMS maturity, as well as elements such as organization size, annual revenue, and company scope of operations. The results are presented in Table 4.

For the majority of actions taken by organizations in crisis situations, no correlation with the level of QMS maturity was found. The type of measures taken in response to restrictions was most likely determined by the type of activity conducted by the organizations. Based on the analysis of Spearman correlation coefficients, it can be concluded that there was a statistically significant relationship ($p > 0.05$) between the adaptation of organization to pandemic conditions and variables such as the size of the organization, income level, and scope of activity. The implementation of certain elements of remote work, such as online training, meetings, and recruitment, was also impacted by the income level. Conversely, the decision to form a crisis team and initiate remote audits was influenced by the size of the organization. Additionally, the implementation of an electronic document flow system was positively correlated with the scope of the company's activities.

As predicted, the level of QMS maturity was statistically significantly correlated ($p > 0.05$) with actions that can be defined as "systemic". The higher the level of organizational maturity, the greater the tendency to form crisis teams ($r = 0.543$), implement electronic document flow systems ($r = 0.207$), transition (partially or completely) to remote audits ($r = 0.255$) and include remote work in the auditing system ($r = 0.291$).

Table 4. Factor influencing action taken by organisation in response to crisis (Spearman correlation coefficient) (own elaboration)

Actions	Organizations basic characteristics				QMS Maturity	Factors that constitute QMS Maturity*			
	company size	annual income	range of operations	number of QMS recertification cycles		Positive impact of audits on the functioning of QMS	Efficient document flow	Involvement of top management	Motivating role of QMS representative
Implementation of mandatory sanitary restrictions (DDM)	0,153	0,030	0,033	-0,028	-0,006	0,045	-0,026	-0,010	0,019
Closure of access to social rooms and meeting rooms	0,078	0,151	0,137	-0,094	0,083	0,025	0,029	0,034	0,059
Work schedule reorganization	0,357	0,378	0,202	0,135	-0,030	-0,076	-0,107	-0,097	0,004
Shift work and/administrative staff duty shifts	0,032	0,157	0,115	-0,020	0,021	0,038	0,029	-0,071	0,044
Establishment of a crisis team	0,257	0,180	0,055	0,142	0,543	0,349	-0,039	0,238	0,320
Remote document circulation	-0,078	0,108	0,188	-0,058	0,207	0,050	0,360	-0,008	-0,034
Partial or complete transition to remote audits	0,255	0,130	0,133	-0,027	0,129	0,068	0,128	0,254	0,403
Inclusion of remote work areas in the auditing system	-0,052	-0,034	-0,090	0,080	0,291	0,467	0,129	0,175	0,066
Organization of management meetings and employee meetings remotely	0,284	0,271	0,076	-0,020	-0,033	-0,026	-0,075	-0,063	-0,123
Remote staff training	0,107	0,240	0,090	-0,086	-0,141	0,037	-0,093	-0,051	-0,097
Remote recruitment interviews	0,011	0,234	0,083	-0,094	-0,021	-0,089	-0,080	-0,163	-0,035
Remote contacts with contractors	-0,052	0,122	0,122	-0,069	0,037	-0,122	-0,038	-0,102	-0,032

*the table includes only those maturity factors that demonstrate a relationship with the implemented measures

**statistically significant correlations at $p < 0.05$ are in bold

Among the factors forming the QMS maturity construct, the involvement of top management and QMS representative proved to be significant. A higher level of engagement by these individuals (prior to the pandemic) was associated with a greater tendency to conduct remote audits ($r=0.254/$

$r=0.432$; management/ QMS representative) and to form crisis teams ($r=0.238/ r=0.320$; management/ QMS representative). According to the research findings, there was also a positive correlation ($r=0.175$) between the involvement of top management and the tendency to undertake audits of remote work

areas.

The second significant factor of the QMS maturity construct was found to be the functioning of the auditing system. Organizations that valued audits and used them to improve their QMS before the pandemic were more likely to establish crisis teams ($r=0.349$) and include remote work areas in their auditing system ($r=0.467$) during the pandemic. Surprisingly, no statistically significant correlation was identified between the efficient functioning of the auditing system and the tendency to partially or completely switch to remote audits. On the other hand, the implementation of remote audits was supported by efficient document circulation ($r=0.128$). As expected, there is also a strong correlation between the efficient functioning of the documentation system (prior to the pandemic) and the implementation of electronic document circulation in response to the crisis ($r=0.360$).

4. Discussion

The implementation of a quality management system is a significant step towards shaping a culture of quality within the organization. The requirement for continuous improvement means that the organization progressively implements and improves actions and strategies that allow for a better tailored QMS to meet internal and external organizational needs. This increases the QMS maturity, which means that system is well-established, documented, and consistently applied throughout the organization. It is also continuously improved based on feedback from customers and stakeholders. As mentioned in the introduction, there are many QMS maturity assessment models that enable a comprehensive assessment. However, due to the number and detail of the criteria, conducting such an assessment can be complicated and time-consuming for organizations.

Therefore, this study proposes a simplified tool for estimating the level of QMS maturity. The motivation for proposing such a solution was primarily the research goal, which was to verify how organizations with an implemented ISO 9001 quality system responded to the crisis of the Covid-19 pandemic. In this context, determining the level of QMS maturity was only an auxiliary factor, enabling differentiation of study participants. Nevertheless, the obtained results provide some insight into the topic of QMS maturity in Polish organizations with an implemented ISO 9001 system.

A review of the literature reveals that in Poland, analyses are being conducted on the maturity of quality management systems (Skrzypek, 2012; Kafel & Sikora 2013; Książek & Ligarski, 2017, Zapłata, 2018). However, there are not many studies on how organizational characteristics influence the development of a pro-quality culture and organizational maturity in organizations with implemented quality management systems.

Wolniak (2019) conducted a comprehensive analysis of factors influencing the level of maturity of quality management systems in Polish organizations. The research showed a significant correlation between QMS maturity and organization size, with smaller organizations exhibiting higher levels of maturity. However, current research yields different conclusions, no significant statistical relationship was observed between the organization size and the level of QMS maturity. The results regarding the relationship between organization size and QMS maturity are inconsistent in other countries as well. For instance, Xiaofen (2013) found that there is an exact opposite relationship (i.e., the larger the enterprise, the higher the level of QMS maturity). The ambiguity of the results may stem from the application of different QMS maturity assessment models, as well as differences between the tested samples. However, at this point, it can be stated that it is not possible to unambiguously determine that the size of the organization has a significant impact on

achieving the level of QMS maturity. Other factors analyzed in the current study, as income or scope of activity have not been identified in the literature as potentially significant for QMS maturity level. However, the relationship between the number of recertification cycles of the Quality Management System (QMS) and the level of QMS maturity, identified in current research, is confirmed in the literature. For example, Souza & Voss [2001] established that maturity occurs as a function of the number of years in the implementation and certification of QMS.

The conducted research has shown that organizations have implemented restrictions resulting from legal regulations (DDM strategy), and these actions were not dependent on the QMS maturity. However, the maturity of the QMS had a statistically significant relationship with actions such as the establishment of a crisis team and the implementation of remote work elements such as electronic document flow and complete or partial switch to remote audits (including audits of newly created remote positions).

During pandemic the traditional approach to auditing processes on-site has been significantly curtailed, and it was unclear when, and under what conditions, it might resume in full. Internal audits require independent auditors who are usually employees from other processes that audited one (Clastka et al., 2020), and in remote work conditions, meetings between both parties were significantly hindered. In case of external audits, requirements for auditing management systems are included in the ISO/IEC 19011:2018 and this standard indicate the possibility of using both direct and indirect contact with the auditee (Nowicki & Kafel, 2022). However, before pandemic the remote approach was not a frequently used method in the certification audit of the quality management system, where the traditional approach in the certification process was preferred (Fonseca et al., 2021).

Current research has shown that there was a statistically significant correlation between the level of QMS maturity and the challenge of implementing audits in a new, remote form. The main factors supporting this decision were management involvement and a positive opinion on the effectiveness of audits as QMS improvement tools. Based on a deeper analysis of remote auditing in surveyed organizations, it was also found that the vast majority of organizations that had experience with remote audits considered that remote work did not affect the credibility of the results of external audits (Kafel & Nowicki, 2022). Furthermore, although most audits could not take place in the previously planned time and/or form due to restrictions related to the pandemic, the transition to remote auditing enabled a decisive majority to carry out their audits (Rozmund & Dziadkowiec, 2022).

The partial correlation analysis revealed that in the factors influencing QMS maturity had an uneven impact on crisis management. It is not surprising that the factor with the greatest impact was the involvement of top management, while the motivating and supporting role of the quality management representative also played a significant role. The ISO 9001 standard requires top management to demonstrate leadership and commitment to the quality management system by establishing a quality policy, setting quality objectives, and ensuring the availability of resources. In a quality-oriented organization, the leader creates conditions for utilizing organizational resources, including the development and abilities of employees. By setting an example, the leader demonstrates identification with the organization's quality goals (Hamrol, 2009). Some researches show that QMS maturity is closely related to leadership. Silva & Matos (2022) found a significant positive correlation between leadership practices and some QMS maturity dimensions in their research on leadership styles in systemic quality management. Wolniak (2019), in his study of QMS

maturity in Polish organizations, noted weaknesses in leadership related to "soft" management aspects. In this context, it can be concluded that current research confirms the role of leadership in systemic quality management, and for the studied organizations, it was also a stimulating factor in implementing actions to prevent the loss of continuity of operations.

5. Conclusion

For the purposes of the article, a simplified QMS maturity assessment tool was developed, which on the one hand is a limitation of this study, but on the other hand contributes to the approach to the QMS maturity problem. Unlike systemic QMS maturity assessment measures, the proposed tool is not comprehensive, but despite this, it is quite effective in allowing for an approximate assessment levels of QMS maturity. Evidence of this is the fact that the use of statistical tool allowed for the identification of organizations at different levels of maturity, and the differences between levels are fully interpretable in terms of content. It can therefore be stated that in analyses where QMS maturity is an auxiliary variable, as in this study, simplified algorithms can be applied. However, this requires further analysis. At this stage of research, it can be stated that depending on the research objective, different factors can probably be selected for QMS maturity assessment. Selection can be made, eg. by expert method, as in this study.

The conclusion of the research is that despite the limited set of factors defining the level of QMS maturity, only 4 out of 10 included in the model played a significant role in responding to pandemic-related restrictions. This was surprising, as both the experts selecting variables for the study and the project authors expected many more correlations to be identified. However, it is not surprising that among the factors influencing QMS maturity, leadership has

References:

particularly significant importance. In this study, leadership was represented by the involvement of top management and supportive and motivating role of QMS representative.

In summary, the results of this study have shown that organizations with implemented the ISO 9001 system, coped well in the unexpected situation of the Covid-19 pandemic. It can therefore be stated that even just implementing QMS makes organizations more resilient to crises, regardless of QMS maturity level. It has also been shown that there is a statistically significant correlation between the level of QMS maturity and crisis actions that can be described as "systemic". This leads to the conclusion that a pro-quality culture has a positive impact on expanding the quality management system to new areas, even in situation of unforeseeable circumstances. Therefore, the thesis that ISO standards are designed to help organizations build their resilience and improve their processes has been confirmed, and that with the development of these systems, organizations are better prepared to deal with crisis situations.

The main achievement of the project is that research was conducted during drastic restrictions. It allowed for insight into the functioning of QMS in atypical conditions. However, the main limitation of this study is the fact that there is relatively little opportunity to verify both the research tool used and the results obtained, due to the fact that the Covid-19 pandemic no longer exists. However, further research is planned, aimed at verifying which of the changes implemented during the pandemic are continued and what impact they have on the functioning of quality management systems.

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