

APPLICATION OF SELF-EVALUATION MODEL IN THE QUALITY-ORIENTED PRODUCTION ORGANISATION IN A MACHINERY INDUSTRY COMPANY

Marta DUDEK-BURLIKOWSKA

Silesian University of Technology, Faculty of Mechanical Engineering, Department of Fundamentals of Machinery Design; Marta.Dudek-Burlikowska@polsl.pl, ORCID: 0000-0003-2056-7250

Purpose: To undertake a non-formalised assessment of a contemporary quality-oriented manufacturing organisation, which will provide a comprehensive source of information for learning and defining change; for the creation of a concept for perceiving the development of a company on the basis of a quality criterion; and will make it possible to determine its level of excellence as perceived through the prism of the completed sheets of the MSOP Model and the obtained value of the manufacturing organisation quality index.

Design/methodology/approach: The self-assessment of the organisation was carried out using the MSOP model, which is both qualitative and quantitative in character. The methodology used provides the opportunity to interpret the organisation's activities using a substantive constatement of the factors of each attribute in the MSOP model, these being, in turn: Customer orientation, Organisational improvement, Organisational strategy and culture, Production process and technology management, Intellectual capital management, Quality management, Occupational safety and environmental protection. In addition to the praxeological interpretation the MSOP model is supplemented by the weighting magnitudes of the individual factors for a proper quantitative interpretation of the quality level of the organisation.

Findings: The most important findings relate to obtaining information on the areas of organisational activity (attributes) in which self-assessment is very high and also those in which improvement measures should be taken as soon as possible.

Research limitations/implications: The example given is only the beginning of an organisation's journey towards maturity assessment and the development of a strategy for continuous self-assessment in the years to come. The cyclical nature and objectivity of the research is important.

Practical implications: the MSOP model can serve as a model for organisations that are considering the use of non-formalised self-assessment models for their own development and improvement, with a future attempt at a quality award.

Social implications: the continuous development of the organisation, its processes, and the upgrading of staff competences will enhance the quality of life of the organisation's community.

Originality/value: The publication contains the author's model for self-evaluation of production organisations, together with an example and its analysis.

Keywords: organization's maturity, improvement, self-assessment, total quality management.

Category of the paper: Research paper.

1. Introduction

Today's manufacturing organisation faces many challenges, and this is subject to many changes and transformations, on the one hand, and strives to achieve a high position in the market on the other. The transformations will influence the determination of the rules of operation, the interactions and the definition of the ways in which the company will develop. Thus, the success of the modern organisation will be determined by the assumptions of a knowledge-based economy, focused on quality, taking into account the development of intellectual capital, the culture of the organisation and environmental and social conditions.

The contemporary manufacturing enterprise is therefore multifaceted, emphasising the importance of its external and internal forms, which concern both defining expectations and determining the degree to which customer requirements are met, as well as defining an appropriate strategy integrated with the implementation of activities within the organisation, such as developing a vision and mission, describing a quality policy and establishing objectives at strategic, tactical and operational levels. An important element in such a defined action is also the appropriate distribution of competences and responsibilities in a clear organisational structure correlated with properly defined and interrelated processes operating in the organisation. Thus, when shaping a modern production organisation, it should be emphasised that the right form of managing it is one that very consciously implements tangible and intangible resources to achieve its goals, and treats it as a continuous process of decision-making and is able to make the right choice as to the style of management and ways of improving it. By viewing its activity through the prism of creating a modernist management concept, this form builds a stable image and thus creates a value-added philosophy for the organisation.

An important element of the organisation's activities is also the correct definition of its processes and the links between them (process map) and the determination of the form of the validation procedure for the systems it has in order to confirm the adequacy of meeting the requirements described by the organisation, as well as seeking ways to define its own maturity and the yardsticks for measuring it.

In the literature on the subject, E. Skrzypek points out [...] that the maturity of an organisation is a certain level of skills, as well as excellence, it is the degree to which the organisation is prepared to perform its tasks, implement its objectives. The determinants of high maturity can include effectiveness, efficiency and effectiveness [...] (Skrzypek, 2010). The effectiveness of an organisation's performance is reflected in its relationship with the environment, especially in its relationship with customers and other stakeholders, and in its position in the market, as well as in the achievement of the organisation's defined objectives. Efficiency makes it possible to assess the ability to act in the planned way and to evaluate the efficiency of the process. Thus, it becomes important to continuously review the organisation's activities in order to inform its further actions.

A survey conducted by the author of this article (Dudek-Burlikowska, 2015) indicates that many organisations have difficulty in choosing the right self-assessment model to implement. On the positive side, however, is the organisation's knowledge of self-assessment topics and methodologies. Companies are also aware of the need for self-assessment, are not afraid of it and do not consider it unnecessary work. Management largely identifies with the activities carried out and emphasises the importance of their regularity. Staff resistance is also not very visible. Unfortunately, there is a barrier related to formal competition evaluations, companies feel that the criteria indicated are not always interpreted correctly and feel inadequate in terms of proper formulation in relation to the specifics of their activities. Organisations accentuate the lack of evaluation criteria, important in their view, that reflect the individual character of the organisation in the models in operation, necessary for the organisation to carry out its self-assessment. Among these criteria, the organisations indicated aspects related to technology and production management and the importance of valuing the intellectual capital of the company. The surveyed organisations also signalled that the current solutions are not universal enough to sufficiently address all areas relevant to the needs of manufacturing organisations and at the same time involve employees at different levels in the self-evaluation procedure.

Currently, the most well-known but not always appreciated form of self-evaluation is participation in the Polish Quality Award competition, which involves the preparation of a self-evaluation report by top managers and its verification by experts during an audit. The defined areas form the basis of the assessment without the possibility of omitting any of them or replacing them with one's own. Each competition is a verification by an external auditor of the current state in the organisation with the prepared documentation, i.e. the self-assessment report, which may cause stress, tension and thus not serve to create added value for the improvement of the organisation.

Thus, the self-evaluation model should be used for internal use within the organisation and implemented at all levels of the organisation's management by involving representatives of each employee group in the evaluation. This will result in a more effective diagnosis of problems and, consequently, a wider range of concepts and ideas that can be included in defined plans to improve and enhance all the organisation's processes. Both the author's research (Dudek-Burlikowska, 2019) and the analysis of national and international literature have confirmed that there is a cognitive gap at the substantive level concerning the appropriate, non-formalised way of self-evaluation of the processes of a functioning production organisation focused on quality and improvement.

Table 1 presents the forms of self-evaluation present in the literature and also indicates the solutions proposed by the author in the area of the possibility of self-evaluation by a modern production organisation.

Table 1

A summary of the state of available assessment models in the literature and the positioning of the author's proposal

Nature of the self-assessment model organisations		Existing models		The author's proposal for manufacturing organisations
		<i>Polish</i>	<i>international</i>	
Formalised forms of assessment	Reward-based models	Polish Quality Award, Regional Quality Awards	EFQM model, E. Deming Quality Award, M. Baldrige Quality Award	
	Standards-based models	Assessment model in accordance with EN ISO 9004:2010	Assessment model according to ISO 9004:2010	
Informal forms of assessment	Models for organisational diagnosis and improvement as added value	Systematic assessment of the organisation R. Kolman	no	Model for the self-assessment of a quality-oriented manufacturing organisation (MSOP) with a substantive statement
	Defined maturity models	E. Fiddler	B. Crosby	
	Estimation of a production organisation through valuation	Kwalitonomic assessment of the organisation's quality levels R. Kolman		Estimation of the Production Organisation Quality Index - W_{JOP}
	Other forms of assessment development-oriented organisation	no	no	Analysis of the manufacturing organisation's self-assessment through the prism of opportunity and threat analysis of defined scenarios

Source: own elaboration.

Nowadays, the way to assess the organisation's performance should be a formula that reflects the achievement of the defined organisational objectives and provides an opportunity to assess the organisation's performance, thus indicating its level of maturity.

This level depends on the degree of sophistication in the perception of the organisation's own development by the self-assessment method used towards achieving excellence. It is justifiable, therefore, to find the right form of self-acceptance for an organisation to highlight its own value, to claim a high level of product quality, and to emphasise the functionality of processes, proper work organisation and flexibility of information flow.

In this context, the article presents a Self-Assessment of Company X of the engineering industry based on the criterion of quality using the Self-Assessment Model of the Quality-Oriented Production Organisation (MSOP). This model is a modern form of monitoring and improving the performance of manufacturing enterprises managed by managers at all organisational levels and is described in detail in publication (Dudek-Burlikowska, 2019) by the author of this article. The proposed solution has been developed to carry out an effective self-assessment of activities in organisations, to calculate an index of the quality of the

organisation, as well as to indicate and estimate the probability of possible opportunities and threats by applying scenario methods in the area of management of a manufacturing organisation. The strengths of the model are undoubtedly its adaptation to the specifics of manufacturing organisations, the flexibility of the approach according to the needs of the organisation and the possibility of preparing a diagnostic report on the basis of the assessment and planning further improvement activities.

The MSOP model, is implementable in any manufacturing sector and applicable at any organisational level. It makes it possible to assess the current state within an organisation and guide its further development in the pursuit of excellence. The formulated MSOP Model worksheet facilitates the estimation of the organisation.

2. Contemporary perceptions of a quality-oriented enterprise - theoretical aspects

2.1. Quality management in modern organizations

The origins of management theory provided the inspiration for today's perspective on managing a modern quality-oriented organisation. By showing the correlations between the currents of management and the formation of the contemporary concept of quality, it can be concluded that the dynamics of the development of management knowledge has influenced the definition of quality management (Table 2). Analysing the assumptions of the classical school of management, it is possible to see elements that relate directly to quality management, namely the shaping of ways to improve as well as the responsibility of employees, while in the behavioral approach it is essential to value the initiative of employees as well as limiting full control (Szczepańska, 2013).

In the literature, it is possible to see many connections between the subjective evolution of quality management and concepts for building organisational strategy, forms of approach to the environment, activities related to defining market aspects, as well as opportunities to view the organisation through the prism of processes. There is a cross-fertilisation of these areas for the benefit of a quality-oriented organisation.

Table 2.
Relationship of TQM to classical management theory

Developer of the theory	Theory topics	Relationship with Management by Quality
F. Taylor	Scientific management	Management by facts, TQM tools and techniques and problem solving
H. Fayol	Planning and organising	Business process management
M. Weber	Economic organisation	Leadership
A. Sloan	Decentralisation of organisations	Business process design and management.
E. Mayo	Human relations	Employee satisfaction. Creating a system of motivation
D. Mc Gregor	The human factor of the organisation	Employee involvement in management, motivation
P. Drucker	Result orientation, the role of leadership in management	Leadership goal development, process orientation
M. Balbin	Creating teams	Group dynamics, teamwork
Ch. Handy	Internal culture	Organisational values, forms of communication, work culture
H. Mintzberg	Strategic planning and management	Creating a mission vision and objectives

Source: compiled on the basis of Dudek-Burlikowska, 2015, pp. 229-236; Szczepańska, 2013.

Thus, over the years, the role of quality management has been changing from a strict supervisory function, through 100 per cent and random quality control, to quality assurance, system activities and then methodologies for incorporating more and more organisational functions into quality management, to the current comprehensive quality management (Figure 1) (Dudek-Burlikowska, 2013; 2019; Skrzypek, 2000; Tkaczyk, 2000). Today's companies are affected by the high pace of change in the market and its immediate environment. Growing competition, ever-increasing customer expectations, the required high quality of products, the achievement of optimum levels of operational efficiency, the estimation of process risks and the high potential of employees' intellectual capital are all factors that determine the nature, as well as the way in which a company operates. Top management therefore acts with the conviction that it is necessary to continuously improve the aforementioned elements.

Quality management is thus becoming an explication for organisations currently operating in a dynamically changing environment. According to K. Bielcher, an organisation operates in an environment of constant challenges and changes, resulting in the complexity of the processes and problems facing the organisation, which are growing simultaneously. According to the concept of integrated process management (K. Bielcher), an organisation is a holistic entity in which the complementation and interpenetration of organisational elements on a rational and emotional level occurs naturally. This methodology is formed on the basis of two paradigms, namely: a holistic view of the world and a reductionist view of reality (Bugdol, 2007; Szczepańska, 2013). Thus, it is oriented towards the consolidation of the organisation's forms of management and its implemented formalised and non-formalised systems, in which employees identify with the philosophy of comprehensive quality management and every activity of the organisation is considered process-wise through the prism of its continuous improvement (Dudek-Burlikowska, 2015).

Today, therefore, business management and its improvement is a continuous, long-term activity, involving all processes and involving employees at every level in the belief that the defined activity is for the good of the company (Peters, Waterman, 2011). The BQA defined that comprehensive quality management as a team-based concept of organisational management for which the integration of customer needs with the goals of the organisational unit is paramount. This approach indicates the importance of the aspects of interaction between employees at all levels of the company in every process taking place, taking into account the conscious application of available methods, quality techniques (Dudek-Burlikowska, 2019).

R. Kolman pointed out that the essence of quality management in an organisation is the employees, who create quality through their entire activity (Kolman, 2009). Thus, the shaping and application of the concept of management by quality in an organisation requires their involvement, daily breaking of the previous form of thinking, systematic improvement of the intellectual capital they possess and directing their attention to the so-called 5 K's, i.e.: customer, cost, creativity, communication and culture (Kolman, 2009; Peters, Waterman, 2011; Skrzypek, 2014).

The literature identifies a number of universal principles in the area of quality management and improvement, the implementation of which is aimed at achieving quality objectives. These include the involvement of the organisation's management in solving quality issues, the elimination of communication barriers in the organisation (improving communication both between employee and manager and between staff and consumer), the implementation of a system of training and motivating employees, the conduct of employees aimed at improving products and processes, and learning about consumer expectations by surveying customer opinions about the services provided (Deming, 1982; Dudek-Burlikowska, 2014; Oakland, 1992; Szczepańska, 2013).

In the European models, the following principles can be specified for aspects of management by quality: customer orientation, management by facts, people-oriented management, continuous improvement process. In Japanese models, on the other hand, the following rules are defined: management commitment, employee focus, customer focus, focus on facts, continuous improvement (Kaizen), universal participation, elimination of waste (Muda) (Tkaczyk, Napora-Kowalska, 2012).

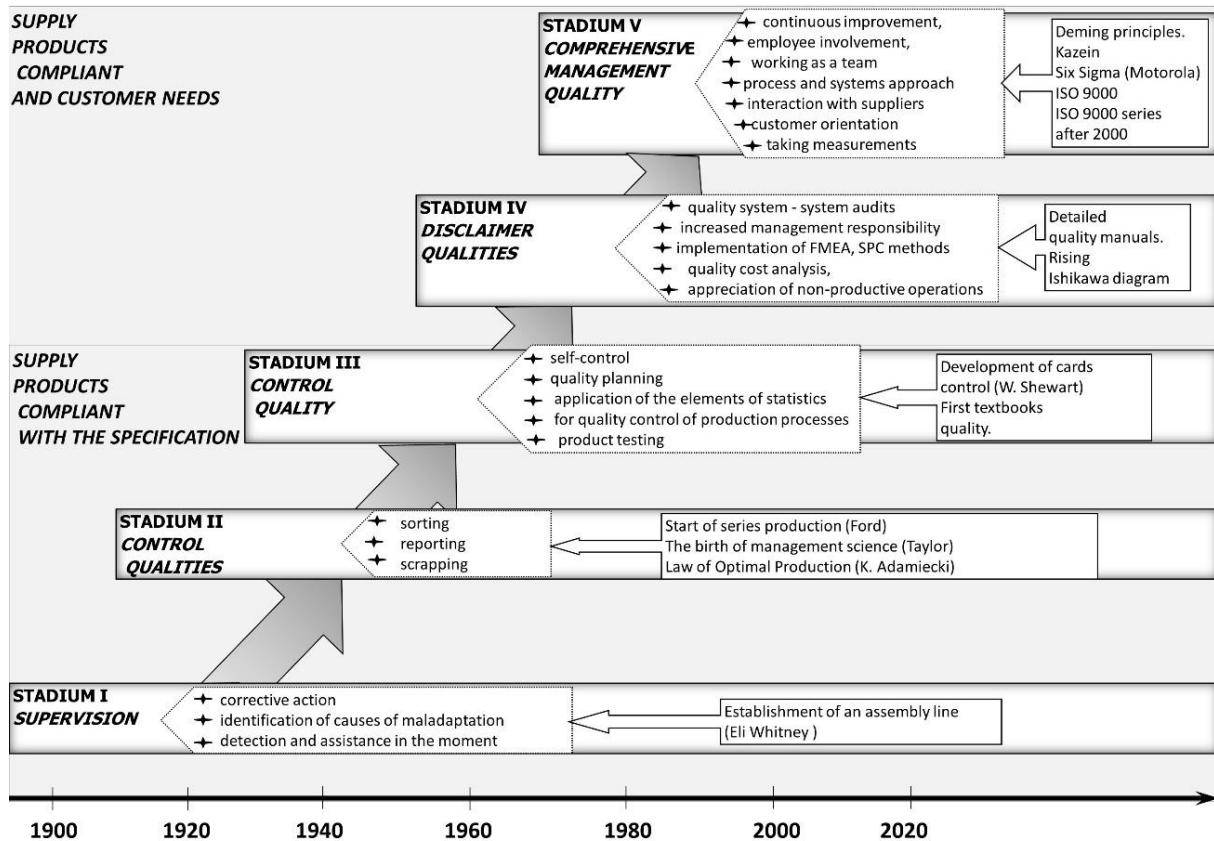


Figure 1. Evolution of the quality management approach.

Source: own elaboration.

The indicated mechanisms are nowadays determinants for many organisations in achieving quality objectives and maintaining proper relations with the environment. Therefore, in order to strengthen its position and reflect the requirements of the ISO 9000 series standards, the ISO/TC Technical Committee defined and then formalised the principles of quality management and made them available for the first time in the PN-EN ISO 9000:2001 standard. The first assumption was that these principles should be helpful to the management in improving the Quality Management System (QMS) in the organisation, in the years 2000-2014 they were treated as a tool for improving the QMS, and currently they constitute a kind of canon of activities that are the foundation of the company's functioning and development.

To sum up, it should be noted that the asset of the modern quality-oriented organisation is the implementation of modern management methods, which should cover with their activity the area of strategic management of the production organisation, and at the same time the aspects of implementation and improvement of each process. Also important is the form of verification of the activities carried out through the use of objective ways of assessing the organisation, for example, through participation in competitions for quality awards, assessment of the advancement of the adopted principles of quality management and comprehensive quality management, implementation of a non-formalised model of self-assessment of the enterprise or its own form of defined assessment (Dudek-Burlikowska, 2019).

2.2. Maturity of the organisation

Nowadays, the image of a process-managed organisation operating in accordance with the assumptions of the concept of total quality management has become the inspiration for defining the concept of organisational maturity and formulating ways of achieving it.

Looking at contemporary enterprises through the lens of the full concept of quality and the process-managed enterprise, as well as through the lens of good practice, has provided the impetus for shaping the definition of process maturity (Skrzypek, Hofman, 2010; Tkaczyk, 2010). Ph. Crosby emphasises that the maturity of an organisation is its ability to professionally implement quality management tools and techniques (Porter, Tanner, 2014; Skrzypek 2004). S. Tkaczyk points to the relevance of relating the concept of organisational maturity to the implemented processes as the ability of the organisation and its processes to systematically deliver increasingly better results, on a par with the need to emphasise the organisation's social responsibility (Tkaczyk, 2010). On the other hand, P. Grajewski states: [...] *implementing the process approach means going through certain stages, which are interpreted in the literature as levels of process maturity of the organisation [...]* (Grajewski, 2007). E. Skrzypek points out that the process of achieving maturity is related to the improvement of skills and the acquisition of certain attributes and an indication of the degree of preparedness for the realisation of tasks. The maturity of an organisation is defined as a certain level of skills and excellence in the pursuit of proper execution of activities, tasks, objectives. Process maturity is the attribute that determines the probability of predictability of the consequences of restarting the process. The maturity of an organisation's processes will therefore be determined by its performance, predictability and the quality outcomes achieved and confirmed. The assessment of high process maturity will also be related to the level of efficiency, effectiveness, productivity and agility (Dudek-Burlikowska, 2019; Skrzypek, 2014; Skrzypek, Hofman, 2010).

In the literature, many authors seek answers to the question of how to properly assess the functioning and maturity of an organisation's processes. A comprehensive and insightful form of defining maturity levels is the concept of E. Skrzypek and M. Hofman, which reflects very well the perception of process management in a company and relates directly to the process approach of an organisation focused on quality and improvement (Figure 2) (Dudek-Burlikowska, 2013; Skrzypek, Hofman, 2010; Tkaczyk 2013).

In the perception of the maturity of the organisation, and thus the achievement of process maturity levels, it is correct to state by E. Skrzypek (Skrzypek, 2013) that [...] *maturity assessment creates a sphere of voluntary valuation of the state of the quality management system. The improvement of effectiveness, efficiency and maturity is part of the current of continuous system improvement by indicating the possibility of improving the existing state of organisational solutions and practices [...]*. When companies carry out such an assessment, it is an expression of employee commitment and the search for continuous improvement. An important aspect, therefore, is to identify where the organisation is in consciously assessing its own level of maturity.

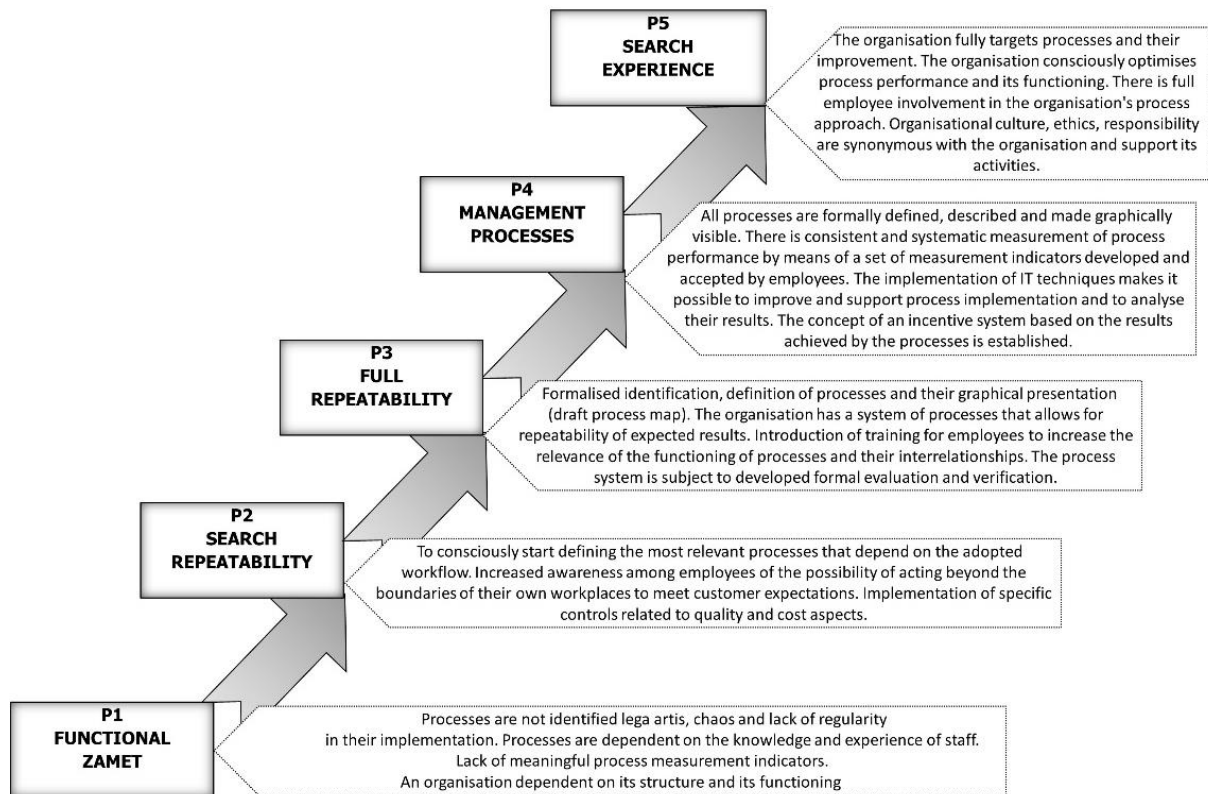


Figure 2. Levels of organisational maturity according to E. Skrzypek, M. Hofman.

Source: compiled on the basis of Skrzypek, Hofman, 2010.

It is therefore reasonable to believe that an organisation that wants to determine its level of process maturity should choose one of the process maturity models and follow it or develop its own, reflecting the nature of the organisation. In addition, it should periodically perform a self-assessment of the organisation, which will be a kind of vector to indicate the direction of its development and its maintenance.

2.3. Company self-assessment

The maturity of an organisation clearly correlates with forms of organisational self-assessment. Nowadays, any organisation implementing the concept of management by quality, and thus seeking confirmation of: the level of excellence of its products, the proper formulation of processes and ways of managing them, the assessment of its development, will carry out its own evaluation.

L.J. Porter emphasises that self-assessment is a learning and development methodology for any organisation. The right perception of excellence and management by quality is a step towards achieving the so-called 'excellence champion' (Porter, Tanner, 2014).

In the PN-EN ISO 9004:2006 standard, the definition of self-evaluation is as follows: *it is a careful evaluation carried out by the top management of an organisation, the results of which are usually opinions or judgements regarding the effectiveness and efficiency of the organisation and the maturity of the quality management system* (PN-EN ISO 9004:2010).

Self-evaluation is therefore a comprehensive, systematic and regular review of an organisation's activities and results in correlation with the chosen business excellence model. This form of activity is the most powerful methodology available for both education and development for the modern organisation. Self-assessment is not only a means of measuring continuous improvement, but also a tool that is an ideal opportunity to integrate business or increase internal organisational excellence across all processes (Dudek-Burlikowska, 2019; PN-EN ISO 9004:2010). A development- and quality-oriented enterprise is aware of the need to improve all its activities and to involve all its employees, and the confirmation of the rightness of such a chosen activity is precisely the conscious submission to self-evaluation.

Companies deciding to undertake self-evaluation are also guided by the need to identify and use indicators to help assess the degree to which defined objectives are being met. The choice of methodology for self-assessment is therefore also one that is consistent with its chosen purpose (Dudek-Burlikowska, 2019; Tkaczyk, 2013).

An organisation focused on success is constantly increasing the number of initiatives in which it participates. These may include business excellence - benchmarking, Six Sigma, Strategic Scorecard (BSC). It is important to emphasise that these initiatives do not negate each other, but are in fact complementary to each other and should be seen as complementary activities within a planned strategy to achieve organisational excellence. Faced with choosing a ready-made model for assessing organisational excellence or developing their own, managers at every level should be aware of the need to define self-assessment functions and principles. Table 3 presents examples of the types of self-assessment principles and functions with their characteristics.

Table 3.
Principles and functions of self-assessment

PRINCIPLES OF SELF-ASSESSMENT (Z)	Name		Characteristics	Correlation with self-assessment functions	(F)
	1.	Purposefulness	Self-evaluation is an intentional activity, linked to the achievement of organisational goals		1
	2.	Complexity	Self-assessment covers all processes and attributes of the organisation		2
	3.	Usability	The results of the self-assessment are a tool for improvement		3
	4.	Continuity	The results of the self-assessment are informative by making many comparisons in the future		4
	5.	Methodology	The self-assessment is carried out in accordance with the procedure developed		5
	6.	Professionalism	The self-assessment is carried out by persons with the appropriate knowledge, skills as well as experience		6
	7.	Formalisation	Self-evaluation is defined and described in the organisation's internal documentation and the results are properly documented and stored		6

Cont. table 3.

SELF-ASSESSMENT FUNCTIONS (F)	Name		Characteristics	Correlation with self- assessment functions	(Z)
	1.	Management	Implementation of self-evaluation results in quality system management decisions		1
	2.	Information	Providing information to management		2
	3.	Motivational	Self-assessment results are a motivating factor for managers of all levels and all employees to improve their work		3
	4.	Corrective	Defining irregularities in the QMS and its functioning		4
	5.	Stabilising	Continuous delivery of activities that meet the requirements and expectations of the organisation		5
	6.	Development	Formulation of future tasks aimed at improving the QMS		6/7

Source: own elaboration.

Self-evaluation processes should involve the collection of data and information about the organisation doing the self-evaluation, and it should be subjected to a real assessment of all its activities. Figure 3 presents a generalised flowchart for the organisation's self-evaluation process. This self-evaluation must be based primarily on team action. This is because no single person working in an organisation has such in-depth knowledge in all areas of the chosen excellence model as to make an independent, reliable, assessment. Objectivity is the most important aspect of selecting members of the evaluation team.

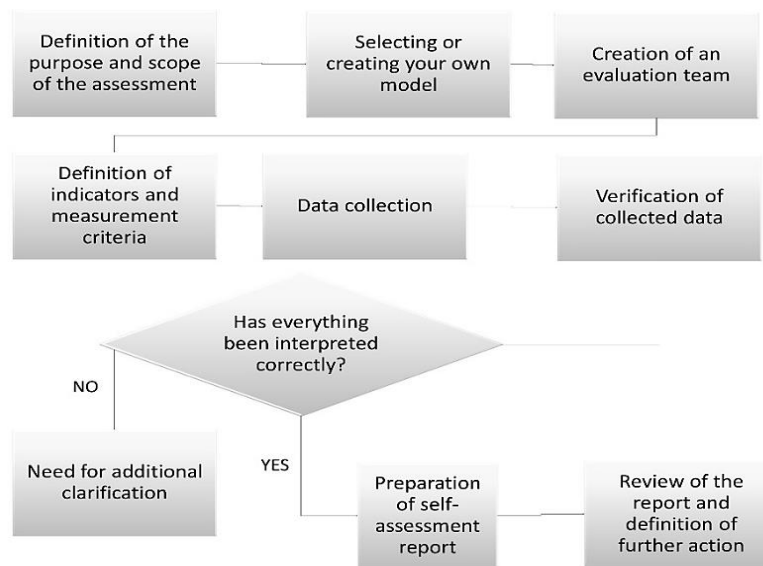


Figure 3. The process of conducting a self-assessment.

Source: own elaboration.

People's perceptions of excellence can be interpreted differently by each evaluator, and a team-based activity makes the whole self-assessment process robust and balanced, while at the same time being different from employees' personal views and experiences (Deming, 1992; Dudek-Burlikowska, 2019; Skrzypek 2000; Tkaczyk, 2010).

In summary, it can be stated that the awareness of the development of the organisation and its continuous improvement for the achievement of the set goals, the fulfilment of the mission and vision, the realisation of the defined strategy and the proper functioning of the processes leads managers to seek the right model for the self-assessment of the organisation, i.e. a model of excellence.

3. The Self-Assessment Model for a Quality-Oriented Production Organisation with usage MSOP Model

3.1. Description of the MSOP model – theoretical aspects

Every modern production organisation should realise the importance of implementing the principles and form of carrying out self-evaluation according to a defined and established scheme. The response to the needs of the organisation is to develop an MSOP model and then a sheet of this model to serve as an estimation tool for the manufacturing organisation. The developed model contains 7 groups of attributes with evaluation criteria, and so sequentially:

- **Attribute A: Customer orientation** - proper definition and interpretation of customer requirements, optimum product price, complaint handling time, customer satisfaction survey, on-time delivery, flexibility of information flow between organisation and customer, formal aspect of dealing with customer property - procedure.
- **Attribute B: Organisational improvement** - compliance of processes with the organisation's objectives, innovation, assessment of the impact of external and internal factors on the organisation's operating strategy, revision of strategy, monitoring of the organisation's processes, involvement of management and employees in the implementation of improvement programmes, self-assessment of the organisation, training of employees at all levels.
- **Attribute C: Organisational strategy and culture** - monitoring the environment, organisational stability, strategy-process relationship, mission and vision versus organisational values, ethical agenda of the organisation, social responsibility, empathy among employees.
- **Attribute D: Production process and technology management** - production resources, process and product design, technology attractiveness, **production** process control, information systems in production, logistics processes, Product compliance.
- **Attribute E: Intellectual capital management** - strategy - HR methodology relationship, employee competences, interpersonal relationships, employee self-evaluation, employee evaluation system, employee development path, motivation system.
- **Attribute F Quality Management:** Identification of inputs and outputs, process relationship quality strategy, audits, PDCA methodology, accessibility to documentation, information flow, system overview, quality methods and tools in processes.

- **Attribute G: Occupational safety and environmental protection** - internal and external communication in the area of OSH and environmental protection, ergonomics of workstations, occupational risk analysis, adherence to principles and guidelines related to safety in processes, 5s methodology, waste minimisation, monitoring of noise, vibration and pollution levels.

Each attribute has seven factors defined on the basis of the Attribute/Factor Validity Grading Methodology. The weight magnitudes of the factors were defined on the basis of conclusions obtained by applying the multi-criteria decision-making method - AHP (Dudek-Burlikowska, 2019). The analysis and calculations made it possible to develop a universal sheet of the MSOP model (Table 4), which is a utilitarian tool for carrying out estimation in manufacturing organisations. The manager evaluation mechanism takes into account the author's formulated nine-point factor evaluation scale. The obtained numerical values of the factor ranks contributed to the formulation of the formula of the Production Organisation Quality Index WJOP based on the developed MSOP model. The assumption is that this index provides an opportunity to assess a quality-oriented production organisation, and its correct interpretation contributes to the knowledge of defining the degree of commitment to the improvement of all the organisation's processes and the forms of their management.

Table 4.
MSOP Model Sheet

Evaluator position - level (tick as appropriate) <i>operational tactical strategic</i>		Data oceny:..... nr sheet:	
Attributes and factors	WEIGHT	Evaluation of the manager*	Result of the assessment
Attribute A		S_{Ai}	$O_{Ai} = W_{Ai} * S_{Ai}$
A 1: Proper definition and interpretation of customer requirements	$W_{A1} = 0.31$		
A2: Optimum product price	$W_{A2} = 0.05$		
A3: Complaint processing time	$W_{A3} = 0.09$		
A4: Customer satisfaction survey	$W_{A4} = 0.19$		
A5: Timeliness of deliveries	$W_{A5} = 0.13$		
A6: Flexibility of information flow on organisation-client interface	$W_{A6} = 0.15$		
A7: Formal aspect of proceedings with customer property - procedure	$W_{A7} = 0.08$		
<i>Attribute value A</i> $W_a = \sum O_{A1} \dots O_{Ai}$			
Attribute B		S_{Bi}	$O_{Bi} = W_{Bi} * S_{Bi}$
B1: Compatibility of processes with assumptions organisations	$W_{B1} = 0.35$		
B2: Innovation	$W_{B2} = 0.04$		
B3: Assessing the impact of factors external and internal on the organisation's operating strategy, reviewing strategy	$W_{B3} = 0.12$		
B4: Monitoring of organisational processes	$W_{B4} = 0.2$		
B5: Management commitment and staff in the implementation of improvement programmes	$W_{B5} = 0.12$		
B6: Organisational self-evaluation	$W_{B6} = 0.15$		
B7: Staff training for all levels	$W_{B7} = 0.08$		
<i>Value of attribute B</i> $W_b = \sum O_{B1} \dots O_{Bi}$			

Cont. table 4.

Attribute C		S _{Ci}	O _{Ci} = W _{Ci} * S _{Ci}
C1: Monitoring the environment	W _{C1} = 0.26		
C2: Stability of the organisation	W _{C2} = 0.24		
C3: Strategy-process relationship	W _{C3} = 0.1		
C4: Mission and vision versus organisational values	W _{C4} = 0.14		
C5: The organisation's ethics programme	W _{C5} = 0.07		
C6: Social responsibility	W _{C6} = 0.08		
C7: Empathy among employees	W _{C7} = 0.09		
<i>Attribute value C</i> $W_c = \sum O_{C1} \dots O_{C7}$			
Attribute D		S _{Di}	O _{Di} = W _{Di} * S _{Di}
D1: Production resources	W _{D1} = 0.18		
D2: Process and product design	W _{D2} = 0.23		
D3: Attractiveness of the technology	W _{D3} = 0.05		
D4: Process control	W _{D4} = 0.27		
D5: Information systems in production	W _{D5} = 0.05		
D6: Logistics processes	W _{D6} = 0.02		
D7: Compliance of products with requirements	W _{D7} = 0.2		
<i>Value of attribute D</i> $W_d = \sum O_{D1} \dots O_{D7}$			
Attribute E		S _{Ei}	O _{Ei} = W _{Ei} * S _{Ei}
E1: Relationship Strategy - HR Methodology	W _{E1} = 0.2		
E2: Staff competence	W _{E2} = 0.4		
E3: Human relations	W _{E3} = 0.04		
E4: Employee self-assessment	W _{E4} = 0.08		
E5: Staff appraisal system	W _{E5} = 0.1		
E6: Staff development path	W _{E6} = 0.05		
E7: Motivation system	W _{E7} = 0.13		
<i>Value of attribute E</i> $W_e = \sum O_{E1} \dots O_{E7}$			
Attribute F		S _{Fi}	O _{Fi} = W _{Fi} * S _{Fi}
F1: Identification of input data and output	W _{F1} = 0.2		
F2: Process relationship - quality strategy	W _{F2} = 0.1		
F3: Audits	W _{F3} = 0.12		
F4: PDCA methodology	W _{F4} = 0.12		
F5: Accessibility to QMS documentation, flow of information	W _{F5} = 0.04		
F6: System overview	W _{F6} = 0.18		
F7: Quality methods and tools in processes	W _{F7} = 0.26		
<i>Attribute value F</i> $W_f = \sum O_{F1} \dots O_{F7}$			
Attribute G		S _{Gi}	O _{Gi} = W _{Gi} * S _{Gi}
G1: Internal communication and external in the field of health and safety and environmental protection	W _{G1} = 0.25		
G2: Ergonomics of workstations	W _{G2} = 0.14		
G3: Occupational risk analysis	W _{G3} = 0.14		
G4: Compliance with rules and guidelines related to safety in processes	W _{G4} = 0.05		
G5: 5S methodology	W _{G5} = 0.19		
G6: Minimising waste	W _{G6} = 0.1		
G7: Monitoring of noise, vibration levels and pollutants	W _{G7} = 0.13		
<i>Value attribute G</i> $W_g = \sum O_{G1} \dots O_{G7}$			
VALUE OF ORGANISATIONAL ASSESSMENT		S_MS_{OP} - $\sum (W_A \dots W_G)$	

Source: own elaboration based on Dudek-Burlikowska, 2019.

The manager's assessment is based on a formulated nine-point rating scale. The least favourable rating is 1 point means unacceptable condition, 2 points is critical condition, 3 points is acceptable condition, 4 points is average condition, 5 means satisfactory condition, 6 is good (favourable) condition, 7 points is very good condition, 8 is outstanding condition and 9 points means excellent condition.

The opportunity to self-evaluate a contemporary quality-oriented manufacturing organisation according to the MSOP model is a chance to define the degree of commitment to improving all the organisation's processes and forms of management.

At the same time, the formula of the Quality Index of the Production Organisation W_{JOP} based on the developed MSOP model was defined. Integrating the developed evaluation sheet and the defined evaluation scale, the following version of the formula (1) was proposed.

$$W_{JOP} = \sum_{i=A}^{n=G} \frac{W_i}{49} \quad (1)$$

where:

W_{JOP} - MSOP organisation quality index,

In_i - sum of scores for each attribute $I = (A...G)$:

$$\begin{aligned} W_A &= \sum (O_{A1} \dots O_{A7})_{A7} & W_B &= \sum (O_{B1} \dots O_{B7})_{B7} & W_C &= \sum (O_{C1} \dots O_{C7})_{C7} \\ W_D &= \sum (O_{D1} \dots O_{D7})_{D7} & W_E &= \sum (O_{E1} \dots O_{E7})_{E7} & W_F &= \sum (O_{F1} \dots O_{F7})_{F7} \\ W_G &= \sum (O_{G1} \dots O_{G7})_{G7} \end{aligned}$$

O_{ij} - the rating of a given attribute as the product of the weight of the factor and the assigned score according to the rating scale.

The maximum possible value to be obtained is 0.45^1 , hence the importance of formulating an interpretation scale for assessing the quality of the organisation (Table 5).

Table 5

Interpretive scale for assessing organisational quality

100-90%	89-70%	69-55%	54-40%	39-20%	19%<
0,45-0,40	0,39-0,33	0,32-0,25	0,24-0,18	0,17-0,1	0,09<
EXCELLENT	VERY GOOD	GOOD	AVERAGE	SMALL	VERY WRONG

Source: own elaboration.

In summary, conducting an Organisation Self-Assessment using the MSOP Model boils down to the following steps:

1. Establishing an organisational Self-Assessment team.
2. Defining the roles in the team.
3. Conducting training on the use of the MSOP Model and the interpretation of the different attributes as instructed: "Substantive statement of the factors of each attribute in the MSOP model for a manufacturing organisation".

¹ 0.45 is the maximum size possible, assuming that the organisation rates its activity as excellent in all factors for each attribute of the MSOP model.

4. Develop a schedule for conducting the annual assessment.
5. Determining the method of collection of MSOP sheets.
6. Calculation of the organisation quality index WJOP.
7. Analysis of the results - defining the improvement actions and added value of the self-assessment, and if possible formulating good practices.
8. Presentation of results among managers and employees.

3.2. Application of the MSOP model in a machinery company – experimental part

The application of the MSOP model is presented on the basis of research results obtained in one of the companies of the engineering industry. The selected company is a medium-sized organisation, operating on the Polish and foreign markets, cooperating mainly with the automotive industry. The surveyed organisation, in order to meet market trends, implemented and certified an Integrated Management System (IMS) in 2008: Quality Management System, Environmental Management System and Occupational Health and Safety Management System. The objectives behind the IMS are to improve production quality, continuously reduce the harmful impact on the environment, achieve the highest possible level of work safety, improve employee-organisation relations, improve information flow, and be open to new standards and forms of process improvement. The organisation in question has so far not participated in quality competitions, nor has it undergone any comprehensive evaluation of its processes. It explained its approach by its aversion to formal quality competitions and lack of access to methodologies worthy of attention in this area. However, with a view to developing the organisation by improving the quality of the processes carried out, and thus the quality of the products offered, the need to carry out a voluntary self-analysis of activity estimation in accordance with the proposed MSOP was identified. In order to obtain a complete picture of the organisation's quality assessment, it was decided to carry out a utilitarian study using the model with the help of organisational representatives selected for this purpose. Individuals at different managerial levels were asked to complete a self-assessment sheet, including: the organisation's director (I), production director (II), sales and marketing director (III), integrated management system representative (IV), QMS coordinator (V), QMS coordinator (I), and QMS coordinator (II). QMS (V), health and safety coordinator (VI), environmental coordinator (VII), selected internal auditor (VIII), production master (IX), HR director (X), sales specialist (XI), purchasing specialist (XII), maintenance coordinator (XIII). The final value of the quality of the organisation will be the average score of the individual managers of the production organisation. Individuals using the scale completed a scoring, and then the importance values for each factor and the values for each attribute were calculated according to the MSOP model sheet developed. The next step was to add up the individual assessment values for each employee and accordingly calculate the W_{JOP} index for each selected employee's individual assessment of the production organisation. Table 5 shows the evaluation values of the organisation made by the employees, while Figure 4 shows the calculated quality indicators of

the production organisation W_{JOP} obtained by each evaluator. Averaging the obtained values of the index W_{JOP} , it was calculated that the quality index of the analysed production organisation is 0.285. Comparing the obtained value with the adopted scale of interpretation of the assessment, it was found that the quality of the organisation is at a good level.

Table 5.

Obtained evaluation of MSOP factors in a manufacturing organisation according to the function of the selected employee (results of research)

Lp.	Selected employee function	The value of organisational assessment (MSOP)
I	Director of the organisation	15,65
II	Production Director	16,05
III	Sales and marketing director	16,35
IV	Plenipotentiary for the Integrated Quality, Environmental and Health & Safety Management System	15,95
V	QMS Coordinator	14,3
VI	Health and Safety Coordinator	13,95
VII	Environmental coordinator	14,3
VIII	Internal auditor (selected)	15,55
IX	Production Master	14,5
X	HR Director	14,9
XI	Sales specialist	14,95
XII	Purchasing specialist	14,55
XIII	Maintenance coordinator	14,55

Source: own elaboration.



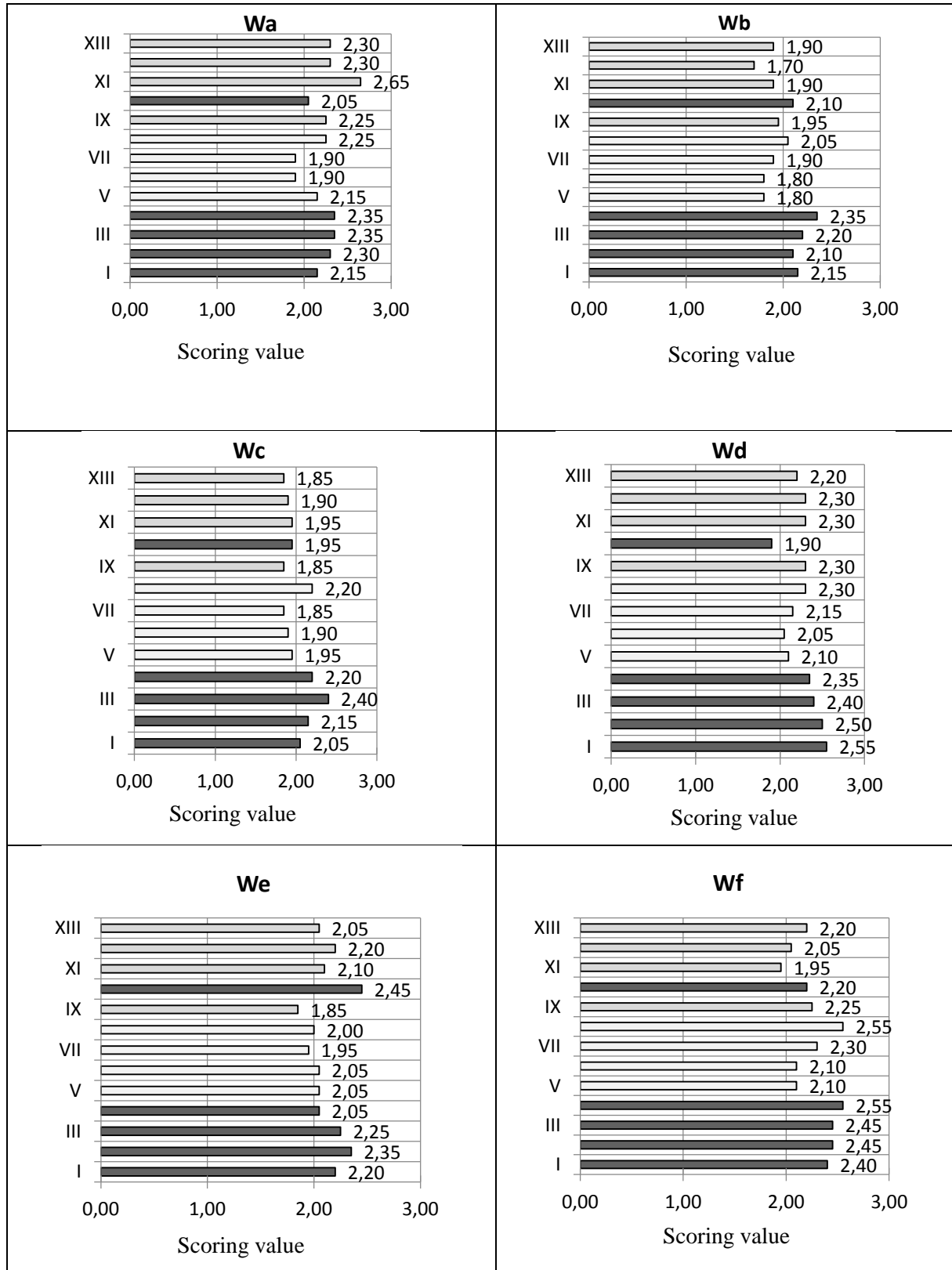
Figure 4. W-index values: W_{JOP} for employees participating in the survey (results of research).

Source: own elaboration.

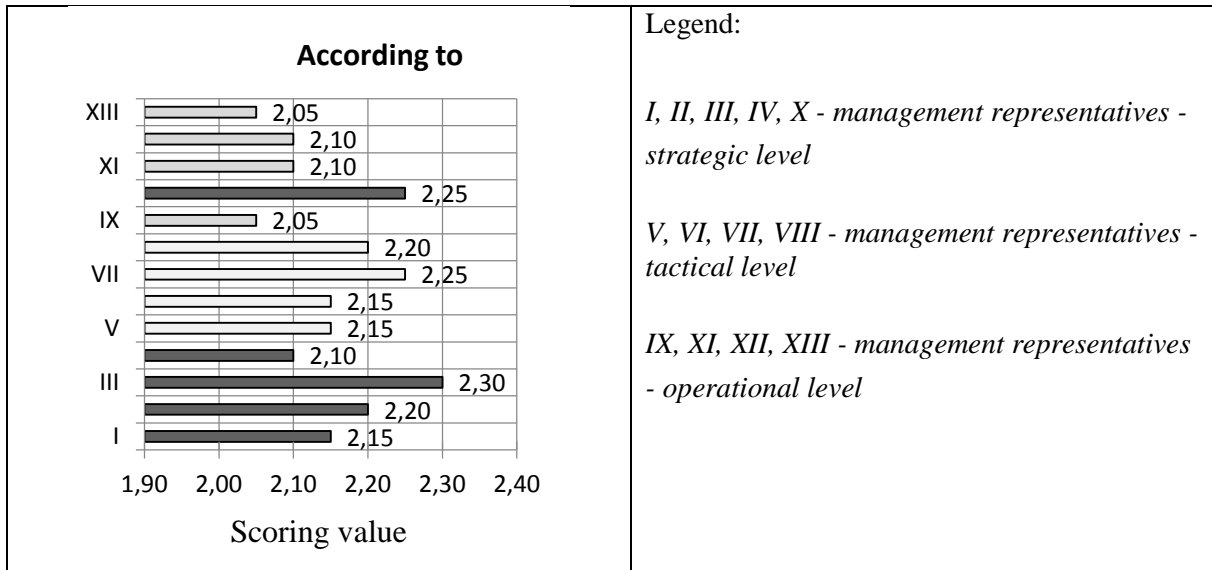
In line with a continuous improvement approach identical to the MSOP, it was assumed that the conclusions obtained from the organisation's self-evaluation would be used to define improvement actions for functioning processes integrated with the organisation's goals and its vision and mission. These will add value to the development of the organisation under consideration. A detailed analysis of each attribute of the MSOP was carried out to identify activities in need of improvement. Table 6 provides a summary of the scores obtained and the importance of the factor for each attribute.

Table 6.

Scoring values with factor importance of individual MSOP attributes in the analysed manufacturing organisation (results of research)



Cont. table 6.



Source: own elaboration.

3.3. Discussion of research results

Attribute A (W_A) - customer orientation. In conducting the assessment, it was indicated that the overall customer-oriented activities in the organisation are rated best by the sales specialist and the sales and marketing director; the organisation's director, the production director and the representative of the integrated quality, environment and health and safety management system also rated this aspect at a similar level. This is confirmed by the fact that the processes related to the activities of the indicated employees are very well interpreted by them and translated into the realised partial objectives and activities, the customer and its requirements are properly defined, and contact with the customer takes place on an ongoing basis. The constant number of customers and the increasing number of requests for quotations confirm that the price of the product is adequate to the sales level and customer expectations. Complaints and the time taken to deal with them are handled according to an established procedure familiar to employees and customers. Elements in need of improvement are aspects related to internal operations (procedure) regarding customer ownership and improving the flow of information between the organisation and the customer, as well as the timeliness of deliveries, which are currently rated at an average level.

Attribute B (W_B) - organisational improvement. This attribute provides information on the correct perception of the production organisation's objectives in this area. Employees at the strategic and tactical level confirm that the implemented process improvement elements are properly planned and implemented, and that information coming from the environment is taken into account on an ongoing basis by the organisation's management. They point out, however, the inadequate form of perception of changes in the environment in terms of broadly understood innovation. The lack of a rapid response reduces their own attractiveness on the market. Older machinery and thus less modern technology can be a potential obstacle to conquering

new markets and, in time, meeting the needs of regular customers. Employees at all levels point to the need to refine procedures for cyclical, objective self-assessment of processes at all workstations by each employee. It is also important to improve the training system in place in the selected organisation. Improving the aspects indicated will positively influence employees' identification with the organisation's improvement goals and raise their awareness of the validity of the activities carried out in this area.

Attribute C (W_C) - the organisation's strategy and culture. This area is best rated by representatives of the organisation's top management - managers at the tactical and operational level oscillate in the approximate rating. The organisation's environment is monitored correctly, but it would be worthwhile to increase the dynamics of the response to change. The stability of the organisation, its credibility and the proper implementation of its goals are emphasised. Employees identify with the organisation's vision and mission and emphasise the strong positive relationship existing between the strategy and the defined processes. Interaction among employees, as well as with customers and stakeholders, is positive. On the other hand, it is worth considering refining the organisation's social responsibility activities, taking into account environmental aspects and actions for the benefit of the community both within the organisation (working environment) and the external environment. The code of ethical conduct also needs to be improved, including provisions emphasising the importance of involving representatives of all employee groups in the modernisation of the organisation.

Attribute D (W_D) - management of production processes and technology. This is an attribute rated very well by all representatives in virtually every factor analysed. Improvement actions are worth taking towards increasing the attractiveness of technology. Thus, the earlier assessment regarding a better perception of innovation and an increased dynamic response to changes in the environment is confirmed. In order to improve the functioning of the organisation's processes, activities related to the implementation of IT solutions in the area of production and auxiliary process management should also be expanded.

Attribute E (W_E) - intellectual capital management. This attribute is rated very good (top management) and good (operational level managers) by selected employees. Middle managers return attention to the need to refine the form of self-evaluation of activities in their positions by all employees, as well as changes in existing procedures for the evaluation of employees by management, linked to a proper motivation system and, consequently, to better formulated employee development paths. The implementation of improvement actions in the area indicated will add value in the identification of employees with the organisation.

Attribute F (W_F) - Quality Management. As the organisation has had a QMSm implemented and certified for more than 10 years, and has been implementing the importance of the TQM philosophy in its processes and indicating in its strategic objectives for several years, it is not surprising that this particular attribute scored highly. According to managers, the PDCA methodology in all activities of each process needs to be refined, as well as the procedure for assessing possible risks in each of the organisation's functioning processes. Operational

managers also point to the need to increase the number of quality methods and tools used in the processes, which will improve their operations and positively influence the quality level of the final product, as well as meeting the increasing demands of customers.

Attribute G (W_G) - occupational safety and environmental protection. This attribute was rated at a good level. Managers associated with the processes in the area indicated emphasise the need to pay more attention to minimising waste and reducing noise and vibration at workplaces, while top management advocates the inclusion of more positions in the 5S methodology, which they believe will improve work safety, reduce production costs, and encourage employees to properly perceive the importance of health, safety and ergonomics in the workplace.

This analysis confirms the validity of the organisation's approach to its development by improving the quality of its processes and products in order to achieve a high position in the market and increase its attractiveness in relation to the competition. The internal confirmation of the achievement of the set objectives will be the demonstration of added value in the evaluation and verification of activities in the area of MSOP attribute factors in the context of quality and improvement, thus achieving an increasingly higher level of maturity for the organisation.

4. Conclusions

The self-evaluation presented has made it possible to conclude that employees at the strategic level evaluate the organisation's activities, and thus the processes in place, best. Middle managers, on the other hand, perceive the greatest risks and are the most stringent in their assessment, with a percentage score of approx. 60%; in their view, many of the company's activities require continuous improvement and even the implementation of corrective measures in some cases.

The self-assessment carried out in the engineering company represents the beginning of the analysed organisation's journey towards achieving the highest level of maturity and excellence by continuously building quality awareness among managers at every level and employees. The identification of individual areas (attributes) and their detailed analysis will provide the evidence base for the formulation of further objectives and strategies for the organisation. At the same time, it should be borne in mind that there is a risk of a lack of objectivity in the assessment, both in over-assessment and over-assertion in the assessment.

Therefore, it is very important to select the team for the self-assessment and to conduct team training for a proper understanding of the MSOP Model worksheet and how to interpret the factors. The formulation of a timetable for the annual evaluation will add value to the reliability of the self-assessment and the detailed analysis of the results.

In this way, after the annual cycle is completed, it will be possible, for example, to develop radar charts and correlate them with the company's goals set and achieved, which will allow constructive conclusions to be drawn and realistic improvement actions to be planned.

Additionally, for utilitarian purposes, the author plans to develop a computer application of the MSOP worksheet to facilitate the self-assessment of the organisation by a self-defined group of employees. In order to illustrate and interpret the results in detail, the application will potentially be extended to include the use of quality statistical tools and correlated with selected quality methods.

Thanks to the developed tool, it will be possible to verify the self-assessment carried out, keep it cyclical and thus make comparisons and interpret them in order to take appropriate improvement measures in the future.

The periodic calculation of the quality index of the production organisation WJOP will make it possible to monitor the self-evaluation of the organisation both in its entirety - based on the evaluation of all MSOP self-evaluation sheets - and in its partial aspect, with a breakdown into groups of employees taking part in the self-evaluation. Carrying out further exemplifications of the model will aim to define the maturity levels of contemporary manufacturing organisations. These levels should reflect the organisation's self-assessment and its ability to identify with the definition of a self-learning organisation.

Complementing the measures indicated will be an analysis of the risks present in the organisation's processes. With the assumption that risk causes deviation from expectations - positive or negative - an important aspect will potentially be the development of risk measurement procedures based on the MSOP model.

Using the defined attributes and factors, it will thus be possible to demonstrate the correlation between the estimated risks and the opportunities and threats of the manufacturing organisation.

Confirmation of the right way to think about quality in an organisation is to implement organisational self-assessment mechanisms, to achieve a high level of quality maturity, and to win a regional, national or European quality award. In other words, a manufacturing enterprise in the modern world is aware that the integration of management in all aspects is embedded in quality management and the improvement of each process.

Consequently, an important strength of the organisation is its ability to create knowledge, the involvement of employees at all levels in day-to-day activities in order to achieve defined goals, as well as its expansiveness in the search for ways to improve. By developing a process- and employee-oriented improvement methodology in the organisation, and this the indicated Self-Assessment Model for a Quality-Oriented Production Organisation, it is possible to transform the organisation's weaknesses into strengths and thus reduce threats and increase opportunities in a dynamic environment.

The contemporary form of creating a manufacturing organisation is actually a number of defined assumptions and performed activities, which interact and influence each other, so that changes in one area have repercussions in other aspects of its functioning and improvement. Thus, the pursuit of excellence is the conscious management of an organisation, characterized by: continuous activity, the right relationship between the organisation and the customer, the importance of valuing the creative thinking of employees, the implementation of the organisation's strategy, the recognition of corporate social responsibility.

In conclusion, it is worth quoting E. Skrzypek and S. Tkaczyk who believe that looking at quality in an organisation today as the most important management mechanism leads to a modern form of industrialisation. What follows is the creation of a culture and philosophy of management by quality, and this is evidence of the organisation following the ever-changing needs of customers and the consistent thinking of all employees as regards improving all activity and all processes in the organisation.

References

1. Bugdol, M. (2007). *Wartości organizacyjne. Szkice z teorii organizacji i zarządzania*. Kraków: Wydawnictwo UJ, 104-155.
2. Deming, E.W. (1982). *Quality, Productivity and Competitive Position*. Cambridge: University of MIT Press.
3. Dudek-Burlikowska, M. (2013). Ocena jednostki organizacyjnej w oparciu o kryterium jakości z wykorzystaniem metody uśrednionych grup znaczeniowych jakości. In: E. Skrzypek (ed.), *Dojrzałość organizacji – aspekty jakościowe*. Lublin: Wydawnictwo Uniwersytetu Marii Curie Skłodowskiej.
4. Dudek-Burlikowska, M. (2014). Osiem zasad zarządzania jakością elementem doskonalącym przedsiębiorstwo. Część II. *Ekonomia i zarządzanie, vol. 6*.
5. Dudek-Burlikowska, M. (2015). The concept of Total Quality Management and the contemporary entrepreneurship in practice. *Journal Achievements Materials Manufacturing Engineering, vol. 73, iss. 2, 229-236*.
6. Dudek-Burlikowska, M. (2019). *Ocena współczesnej organizacji produkcyjnej ukierunkowanej na jakość*. Gliwice: Wydawnictwo Politechniki Śląskiej.
7. Grajewski, P. (2007). *Organizacja procesowa*. Warszawa: PWE.
8. Kolman, R. (2009). *Kwalitologia*. Warszawa: Placet.
9. Oakland, J.S. (1992). *Total Quality Management*. London: Taylor & Francis.
10. Petres, T., Waterman, R. Jr (2011). *W poszukiwaniu doskonałości w biznesie. Doświadczenia najlepiej zarządzanych firm Ameryki*. Warszawa: MT Biznes.

11. PN-EN ISO 9004:2010: *Zarządzanie ukierunkowane na trwałą sukces organizacji – Podejście wykorzystujące zarządzanie jakością*. Warszawa: PKN.
12. Porter, L.J., Tanner, S.J. (2014). *Assessing Business Excellence. A guide to business excellence and self-assessment*. Oxford: Elsevier Butterworth-Heinemann.
13. Skrzypek, E. (ed.) (2013). *Dojrzałość jakościowa a wyniki przedsiębiorstw zorientowanych projakościowo*. Warszawa: Difin.
14. Skrzypek, E. (2000). *Jakość i efektywność*. Lublin: UMCS, 98-11.
15. Skrzypek, E. (2004). *Efektywność podstawą sukcesu*. Lublin: UMCS.
16. Skrzypek, E. (2014). Nowa gospodarka jako paradygmat wzrostu gospodarczego. In: E. Skrzypek (ed.), *Wpływ wiedzy na sukces organizacji na sukces organizacji w nowej gospodarce*. Lublin: UMCS.
17. Skrzypek, E., Hofman, M. (2010). *Zarządzanie procesami w przedsiębiorstwie*. Warszawa: Wolters Kluwer.
18. Szczepańska, K. (2013). *Doskonalenie zarządzania jakością. Podstawy, ocena, perspektyw*. Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej.
19. Tkaczyk, S. (2013). *Organizacja dojrzała – dalsze wzywania*. E. Skrzypek (ed.). Lublin: UMCS, 47-51.
20. Tkaczyk, S., Napora-Kowalska, E. (2012). *Strategia zarządzania jakością*. Warszawa: Difin.
21. Tkaczyk, S. (2010). *Quality Management, Selected Aspects*. Warszawa: Dom Wydawniczy Elipsa, 21-44.