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CONSISTENCY OF THE PERFORMANCE MANAGEMENT SYSTEM AND ITS QUANTIFICATION USING THE Z-MESOT FRAMEWORK

Abstract: *The main purpose of this paper is: (1) to present the theoretical approach for testing a performance management system`s consistency using the Z-MESOT framework and (2) to present the results of empirical analysis in selected manufacturing companies. The Z-MESOT framework is a managerial approach, based on the definitions of attributes for measuring and assessing the performance of a company. It is a quantitative approach which can proof the degree of the performance management system`s consistency. The quantification comes from arithmetical calculation in the Z-MESOT matrix. The consistency of the performance management system does not assure the final performance. Consistency is a part of the systemic approach to the management even if we do not call it as quality management. A consistent definition of the performance management system can help enterprises to be flexible and to be able to quickly respond in the case of any changes in the internal or external business environment. A consistent definition is represented by a set of 21 performance indicator attributes including the requirement for measuring and evaluating strategic and operational goals. In the paper, we also describe the relationships between selected requirements of the ISO 9001:2015 standard and the Z-MESOT framework.*

Keywords: *performance, performance management system, consistency, ISO 9001:2015, Z-MESOT framework*

1. Introduction

Consistency is usually defined as an agreement, harmony, or compatibility, especially correspondence or uniformity among the parts of a complex matter.

The importance of the consistency of any system guarantees its long-term equilibrium. A consistently defined system minimizes externalities leading to the deterioration of the system's balance or even to its demise. System balance is thus a prerequisite for sustainability and consistency is a prerequisite for balance.

Moreover, in our paper we consider the company as a system. Businesses are social systems where people play the dominant role. No system created by human beings or

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system formed with people as its basic elements can be sustainable. The company as a system consists of two main elements:

1) An internal structure as a static aspect of the enterprises, usually represented by an organizational structure and;
2) Internal processes as a dynamic aspect of the enterprises in a system.

Every social system included in a company is target-oriented. The internal structure and internal processes are ordered for the best fulfilment of the stakeholders' objectives. Every unit and process is managed by a manager, and the managers are part of a management system. The management system serves to coordinate all the business units and processes for achieving the business objectives. Based on the internal organization of the company as a system, we can distinguish three main orientations of the enterprise management system. The first is functional orientation, where the basic structure of management is the line managers and organizational units entrusted to them. The second type is process orientation, which forms the basic structure of the process owner and entrusted to a business process. The third type of process emanates from a project-management system, which forms the management structure for the project manager and entrusted to a unique project. The orientation control system does not influence the fact that there are always two subsystems - management subsystem and managed subsystem. The first one represents process owners, line managers, project managers and the second one are the employees. The difference is that in which the structure of the management and realization processes take place. All kinds of orientation management systems have their advantages and disadvantages and the choice is mainly dependant on the size of the company, complexity of realization processes and their degree of automation.

To maintain the balance in the company, as indicated in the introduction, it is necessary to achieve not only a consistent definition of the company as a whole but also its subsystems. One of the subsystems of the enterprise management system is the Performance Management System (PMS).

Every system can be described using a model which includes those parts whose characteristics are of interest to us. The dynamics of the system are represented by the behaviour of the system. The behaviour of the system can be measured and evaluated using the system parameters. The system parameters then show what the characteristics of the system are. It is similar to a company as a system. In order to describe and observe its characteristics, we need to know its structure (static aspects) and processes (dynamic aspects). Parameters to measure its behaviour are then represented by performance indicators (PIs). Each PI is used to observe the behaviour of a particular structure or business process.

The behaviour of a system and the ability to observe it are essential for maintaining its balance. Equilibrium occurs when in the event of deviation from the equilibrium, the system (company) can respond quickly. Rapid response to change ensures the survival of the system. Increasing adaptability to changes ensures a well-established performance management system. A well-designed system is a consistent system.

Perfect consistency is probably impossible for a company. Furthermore, the current rate of change causes organizations to go from periods of "near consistency" to periods of "some consistency." Threat of destabilization is present if the inconsistency of system is too great. (Ramon and Arboledas, 2007).

Závadský (2010), Závadský and Droppa (2013), Závadský and Hiadlovský (2014), Závadská *et al.* (2015) have demonstrated how a consistent performance management system could be defined. We know there are many approaches for constituting an effective PMS, but our approach can give managers a quick view of its PMS consistency as an assumption of the enterprise equilibrium.

2. Literature review

2.1. Consistency as an approach to solve problems

The level of a system's consistency or inconsistency is one of the system`s descriptions. Uniformity among the parts of a complex matter gives us the possibility to adjudicate that object and to ensure its stability or future behaviour. Companies that want to survive need to obey three related laws, say Ramon and Arboledas (2007). According to them, the first rule focuses on achieving minimum levels for effectiveness and efficiency. The nest rule suggests that it is quintessential to understand the indirect dependence between the degree of effectiveness and the degree of efficiency. The last rule states that the way to increase both effectiveness and efficiency is through consistency. Below we prove some problems that can be solved by consistency.

The first area is environmental or human life problems. Tatarkin *et al.* (2014) proposed a consistent assessment of the status and prospects of institutional and innovative subsurface resource management in the Arctic zone. In this case the consistency is defined as a uniform and complete development of the institutional framework of the innovative subsurface resource management. The object is resource management and the consistency is represented by a uniform institutional framework (regulatory support, project support, organizational and financial support) of all countries. Holzkämper *et al.* (2008) developed a consistent framework for knowledge integration to support integrated catchment management. They claim that in managing such complex systems, a specific objective can be achieved through different management actions. However, such integrated decision making is a very difficult and highly complex task, which cannot easily be accomplished by either single or groups of planners. Holzkämper *et al.* (2008) created a consistent framework for the integration of information that are affected by management actions and have impacts on multiple management objectives. Consistency is also shown by Hrdinová *et al.* (2014) and Kayode *et al.* (2016) in their papers focused on sustainable development and environmental effects. Healthcare services can also be consistent (Jilcha and Kitaw, 2016). Ellis *et al.* (2007) examined the consistency of practices in pain management. Liu *et al.* (2008) solved another human life problem. They carried out a study on a consistent and integrated traffic management model and emphasised that that model has to have consistency criteria.

The next area where consistency should be a standard is software engineering and mathematical modelling. Papendieck and Schulze (2014) presented concepts for consistent variant-management tool integrations. Antonacci *et al.* (2013) describe consistent and efficient output-streams management in optimistic simulation platforms and also in software engineering. Ishikawa (2010) expects a consistent integration of selection and replacement methods under different expectations in the service composition and partner management life-cycle. Magnier-Watanabe and Senoo (2007) explored the effect of consistent knowledge management behaviours on competitive advantage. Consistency is very often connected with data management. Awerbuch and Scheideler (2004) describe it in their study of consistent and compact data management in distributed storage systems.

Financial management based on quantitative methods is the next area which usually requires consistency. Ma *et al.* (2013) showed the optimal time-consistent investment strategies in multi-period asset-liability management problems under mean-variance criterion. Time consistency is presented as a mathematical model. Likewise, Ekeland *et al.* (2012) talk about time-consistent portfolio management. Weißenberger and Angelkort (2011) focused on consistency from management's point of view.

A consistent definition can be used for other enterprise`s subsystems as well as for PMS. Augestein, Ludwig and Franczyk (2012) proposed consistent management of logistics services. Hermansson (2005) examines consistency of risk management and presents three models.

The use of mathematical models was a good basis for creating the Z-MESOT framework, as do other authors using modelling. The model represents a system. Parameters included in the model describe its behaviour and the structure of the parameters can be consistent or inconsistent. The level of PMS inconsistency should be calculated and be able to show us the real view of an enterprise`s PMS.

2.2. Views on performance management system

The aim of our paper is not to define effective PMS, but to create an approach to verify its consistency. Consistency is the quality of something that makes it compatible with others and that heightens its effects. Consistent PMS is an assumption of business performance.

The PMS is the topic of study of many authors who have tried to create a model of PMS and its implementation. This described value-based total performance excellence model can serve as conceptual foundation for enterprises designed by Abdullah *et al.* (2012).

It should also be noted that some authors combine performance management with the job performance of employees (Davenport and Gardiner, 2007; Hitka *et al.*, 2015; Soltani *et al.*, 2004; Hitka and Štípalová, 2011). Other authors write about organisational performance (Lari and Asllani, 2013; Delič *et al.*, 2014; Augusto *et al*. 2014; Wong *et al.*, 2014; Elg and Kollberg, 2012; Tuček and Tučeková, 2010). On the contrary, some authors perceive the system as a performance measurement system that is used primarily to measure and assess the performance of business processes, for example, Chang (2006), Chopra and Kanji (2011), Potkány and Hitka (2009), Elg and Kolberg (2009), Sousa and Aspinwall (2010), Šatanová and Sedliačiková (2015) and to achieve excellence (Vujovic and Krivokapic, 2009; Tadić *et al.*, 2009).

The role of performance management in human resource management was explored by Davenport and Gardiner (2007) and Soltani *et al.* (2004) with special focus on meeting total quality expectations in practice. Thus, in our Z-MESOT framework we created PI`s attributes connected to employee`s effort to achieve strategic and operational goals through clearly defined responsibilities in PMS.

According to the findings of Delič *et al.* (2014) systematic improvement of organisational performance should include improving managers' commitment to organisational learning and quality management. The Z-MESOT framework also integrates managers' commitment in PMS which confirms our correct starting points for the creation of it. Lari and Asllani (2013) brought into focus the relationship between the cost of quality (COQ) and performance-improvement measurements, and to suggest that the total COQ be used as an overall measure of organisational performance. The Z-MESOT framework brings independency in PI definition. It shows how to create a consistent PMS regardless of whether we have COQ as an overall measure or not.

Close to our research are authors whose connect the management with measurement (Chopra and Kanji, 2011) Measurement is preferred also by Chang (2006) who developed the model of total quality-based performance measurement, which includes process management at the organizational level, performance appraisal, comparative organizational performance assessment, strategy development and goal deployment and reward and recognition mechanisms. All those attributes above are integrated into the Z-MESOT framework.

Pock *et al.* (2004), Yang and Yeh (2009) have a holistic view on PMS claiming that some organisations have been implementing different management systems simultaneously. Their study confirms that integrated models are feasible and effective. Measurement framework was also developed by Sousa and Aspinwall (2010). They claim that performance measurement systems must contribute to and be integrated with other management objectives. Elg and Kollberg (2009) classified and discussed performance measurement in three phases: the design and structure of the performance measurement system, the utilisation of performance measurement in enterprises' operations and the implementation of performance measurement.

Based on the previous literature review, we move to the heart of our Z-MESOT framework. A consistent basis for PMS is a model. The model contains 21 PI`s attributes by which we can test the PMS consistency. The model is independent of any PI, whether they are COQ or specific PIs presented e.g by Vasiljevic, Trkulja and Danilovic (2014). We have to emphasize that in addition to the systemic view of the organization and its performance, the authors view the performance through the accounting and reporting or through management controls. This aspect of the view of the performance must not be omitted. Tessier and Otley (2012a) and Ferreira and Otley (2009) describe performance management systems in a more holistic manner.

A similar literature review was done by Berry *et al.* (2009). A good foundation for our Z-MESOT framework and a definition of the set of 21 PI`s attributes are three levels of managerial intentions defined by Tessier and Otley (2012b): 1) types of controls (social and technical), which 2) are organised as four control systems (strategic performance, operational performance, strategic boundaries and operational boundaries) and which 3) can be used diagnostically or interactively, have an enabling or constraining role and can lead to either reward or punishment.

Some frameworks were developed for evaluation, if the PMS is effective and suitable for a specific organization. These frameworks serve as a tool for analysis and gave answers to improve PMS. In our paper we investigate the consistency of PMS through the set of 21 PI`s attributes.

3. Z-MESOT framework for testing the performance management system`s consistency

As stated in the Introduction, the proposal of the Z-MESOT framework comes from our previous research results. In the years 2013 and 2014 we wanted to set the premises of consistent PMS from the systems theory point of view. This assumption was based on a homogenous group of attributes of the performance indicator. We used two methodological approaches. The first of them was an affinity diagram, which was used to define attributes of the PI. The second one was an empirical study for defining the minimum set of attributes that are necessary for a consistent PMS.

The final version is the Z-MESOT framework (Measurement and Evaluation of Strategic and Operational Targets) presented in this paper. This framework is a matrix able to determine degree of the PMS`consistency.

3.1. Attributes of the performance indicator

Závadský and Hiadlovský (2014) have demonstrated a systematic approach to measurement and evaluation of the performance based on PI`s attributes. The main objective of the previous research was to define the set of attributes of a PI and to find out which of these attributes are determined in the sample companies. Exploring the frequency of each attribute was the first step of our research. Next, we found the importance of each attribute determined by sampled companies. The last step of the research dealt with the finding of a minimum number of PI`s attributes that make a PMS

functional and consistent. The consistency of a PMS is not based on a maximum or minimum number of attributes, but on the same type of attributes for each PI used in a PMS at all its performance levels.

We defined final groups of attributes of the PI: (1) formal attributes of the PI, (2) attributes of the PI's target value, (3) informational attributes of the PI and (4) attributes of the PI's evaluation. Each group consists of various attributes. The final set of attributes consists of 21 attributes of PIs:

F: Formal attributes of the PI

1) F1: Name of the PI
2) F2: Relation to the business process (name and mark of the process)
3) F3: Relation to the strategic goal
4) F4: Strategic goal (name and mark of the strategic goal)
5) F5: Responsibility for the PI definition

T: Attributes of the PI's target value

6) T1: Responsibility for the target value definition
7) T2: Unit of the PI
8) T3: Period defined for the target value achievement
9) T4: Determinants of the target value definition
10) T5: Target value (number)

I: Informational attributes of the PI

11) I1: Responsibility for data recording
12) I2: Frequency of data recording
13) I3: Place for data recording (name and destination of data store)
14) I4: Source of data
15) I5: Calculation formula
16) I6: Automation of the calculation (manually/software)

E: Attributes of the PI's evaluation

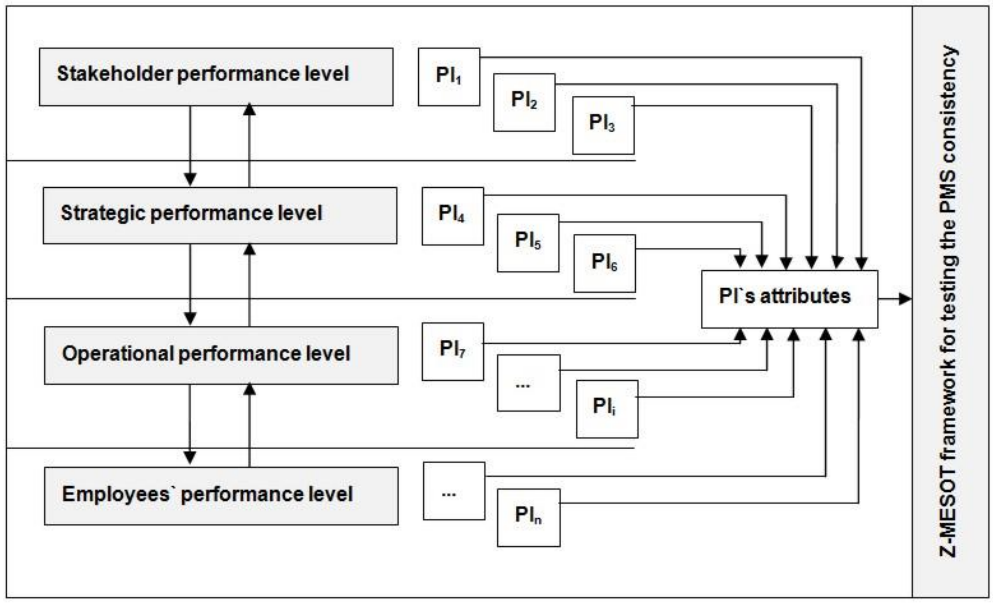
17) E1: Responsibility for the PI's evaluation
18) E2: Frequency of the PI's evaluation
19) E3: Visualisation of the achieved performance
20) E4: Action in the case of a performance gap
21) E5: Warning signals for the evaluator

Figure 1 shows at what performance level PIs can be defined. The main idea of the Z-MESOT framework, however, is not to define specific PIs for each level of performance. For the application of the Z-MESOT framework, it is necessary to define the same set of attributes for all PIs at all levels of performance.

3.2. The Z-MESOT framework and selected requirements of the ISO 9001:2015 standard

The new ISO 9001 standard has increased the number of its clauses. In this section of the paper, we would like to point out some relationships between the selected clauses of ISO 9001:2015 and the Z-MESOT framework represented by the set of 21 PI`s attributes. In Table 1 is shown our definition of possible relationships and example specifications of a number of customer complaints.

The application of the Z-MESOT framework not only tests the consistency of PMS, but it can also be used to meet selected requirements of ISO 9001. In this case it is necessary for each attribute of PIs to define a clear description of its implementation, including responsibility for measuring and evaluating performance. This responsibility is explicitly defined by attributes F5, T1, I1 and E1. It has to be determined by a specific job position for a given attribute. If we want to apply Z-MESOT as a part of the quality management system, then we need to have developed a matrix for the description of the individual attributes and individual characteristics, but at least for the key performance indicators (KPI). Key performance indicators are those indicators (Table 1) that have a relationship to the strategic goal (attributes F3 and F4).



Source: Own elaboration.

Figure 1. Baseline for the Z-MESOT framework application

Table 1. Specification of the PI`s attributes and their relationships to ISO 9001:2015. Own elaboration.

	Attributes of the performance indicator	**Specification**	**Relationships to the selected clauses of the ISO 9001:2015 standard**
F1	Name of the PI	Number of customer complaints (NCC)	6.2.1 b); 6.2.2 e); 9.1.1 a)
F2	Relationship to the business process	VA3.1 Customer satisfaction survey	4.4.1 c); 9.1.1 a)
F3	Relationship to the strategic goal	Yes (NCC is a KPI)	4.1; 9.1.1 a)
F4	Strategic goal (name and mark of the strategic goal)	SG4 Increase of customer satisfaction in following 3 years by 5 %	4.1; 9.1.1 a)
F5	Responsibility for the PI`s definition	Board of directors	4.2; 5.1.1 h); 7.2; 7.3 c)
T1	Responsibility for the target value definition	Chief Marketing Officer	5.1.1 h); 7.2; 7.3 c)
T2	Unit of the PI	%	6.2.1 b); 9.1.1 a)
T3	Period defined for the target value achievement	Year	6.2.1 b); 9.1.1 a); 9.1.1 c)
T4	Determinants of the target value definition	1. Average customer satisfaction of	4.1; 6.2.1 c); 9.1.1 a)

		the 3 previous years 2. The strategic goal value 3. Number of new product innovations in following year	
T5	Target value (number)	2 %	6.2.1 b); 9.1.1 a)
I1	Responsibility for data recording	Marketing officer	5.1.1 h); 6.2.1 e); 7.2; 7.3
I2	Frequency of data recording	Daily	6.2.1 e); 9.1.1 c)
I3	Place for data recording	SAP – CRM	6.2.1 e)
I4	Source of data	Incoming complaints to the Marketing department	6.2.1 e); 9.1.1 a)
I5	Calculation formula	Number of complaints / Number of products delivered * 100	6.2.1 e); 9.1.1 a)
I6	Automation of the calculation (manually/software)	SAP – CRM	6.2.1 e); 9.1.1 b)
E1	Responsibility for the PI`s evaluation	Chief Marketing Officer	5.1.1 h); 6.2.1 e); 7.2; 7.3 c)
E2	Frequency of the PI`s evaluation	Daily	6.2.1 e); 9.1.1 d)
E3	Visualisation of the achieved performance	Bar chart	5.3 c); 9.1.1 d); 9.3.2 c 2, 3, 5); 10.1. c)
E4	Action in case of a performance gap	Meeting: Chief Quality Officer, Chief Marketing Officer, Chief Product Officer	6.1.1 c); 6.1.1 d); 9.3.1 g); 9.3.1 f); 10.1 c); 10.2.1. a)
E5	Warning signal for the evaluator	Notification sent by e-mail form SAP – CRM	5.3. c); 9.3.2 f); 10.1 c)

4. Empirical study of PMS consistency

In this section of the paper we apply theoretical knowledge to conduct an empirical study of PMS consistency. We use the Z-MESOT framework as a main tool to achieve valuable results.

4.1. Methodology of the research

In order to evaluate consistency, we use the Z-MESOT framework (Measuring and Evaluating Strategic and Operational Targets). This framework in Figure 2 shows all attributes of performance indicators (21) in the first column of the framework and more than two real indicators in the first row. In the Z-MESOT framework there must always be more than two indicators for the correct identification of the performance management system consistency.

The consistency of the performance management system is clearly described by the Z- MESOT framework application in the specific business conditions and in

accordance with the analysis of performance indicators. In our paper we focus on performance indicators through selected key performance indicators.

The rows of the Z-MESOT framework provide information about all attributes of the performance indicator A_j. In total there are 21 of them. Therefore $j = 21$. Data in the columns describe specific performance indicators PI_i., where $i = 1, 2, ... n$. In order to evaluate the total consistency of PMS, all indicators used in the company should be included, especially those used in all performance level evaluation as is shown in Table 2.

We can assess whether PMS is partially consistent according to the sum of values in the corresponding lines. The framework consists of values 1 or 0 depending on the fact whether indicator PI_i in the corresponding column has a defined attribute A_j or not, while $Aj \in \{F1, F5; T1, T5; I1, I6; E1, E5\}$. If the attribute is defined, the value 1 is written and if the attribute is not defined, value 0 is entered.

If the given attribute A_j has reached a value equal to the number of indicators n, we consider it as a positive partial consistent definition of all the indicators included in the analysis using the Z-MESOT framework. If the attribute has reached a value of 0, there is also a partial consistent definition, but negative. All values between 0 and 21 speak of inconsistent definitions of characteristics. Mathematically, we can describe partial consistency as the following:

$$\text{If } \sum_{i=1,j=21}^{n} A_{ij} = 0;\ A_i \in \{F1, F5; T1, T5; I1, I6; E1, E5\} \rightarrow \text{negative partial consistency} \quad (1)$$

$$\text{If } \sum_{i=1,j=21}^{n} A_{ij} = n;\ A_i \in \{F1, F5; T1, T5; I1, I6; E1, E5\} \rightarrow \text{positive partial consistency} \quad (2)$$

$$\text{If } \sum_{i=1,j=21}^{n} A_{ij} = (0,n);\ A_i \in \{F1, F5; T1, T5; I1, I6; E1, E5 \rightarrow \text{partial inconsistency} \quad (3)$$

Table 2. Z-MESOT framework. Source: Own elaboration.

			1	**...**	**i**	**...**	**n**	
			Performance Indicator PI_1	...	Performance Indicator PI_i	...	Performance Indicator PI_n	**ΣA_{ij}**
F1	A_1	Name of the PI	$A_{1,1} = 1 \vee 0$	...	$A_{1,i} = 1 \vee 0$	...	$A_{1,n} = 1 \vee 0$	<0,n>
F2	A_2	Relationship to the business process	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
F3	A_3	Relationship to the strategic goal	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
F4	A_4	Strategic goal (name and mark of the strategic goal)	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
F5	···	Responsibility for the PI`s definition	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
T1	...	Responsibility for the target value definition	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
T2	...	Unit of the PI	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
T3	...	Period defined for the target value achievement	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>

T4	A_j	Determinants of the target value definition	$A_{j,1} = 1 \vee 0$	...	$A_{j,i} = 1 \vee 0$	...	$A_{j,n} = 1 \vee 0$	<0,n>
T5	...	Target value (number)	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
I1	···	Responsibility for the data recording	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
I2	···	Frequency of data recording	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
I3	...	Place for data recording	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
I4	...	Source of data	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
I5	...	Calculation formula	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
I6	···	Automation of the calculation (manually/software)	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
E1	···	Responsibility for the PI`s evaluation	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
E2	···	Frequency of the PI`s evaluation	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
E3	...	Visualisation of the achieved performance	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
E4	···	Action in case of a performance gap	... $1 \vee 0$	...	... $1 \vee 0$	...	... $1 \vee 0$	<0,n>
E5	A_{21}	Warning signal for the evaluator	$A_{21,1} = 1 \vee 0$	...	$A_{21,i} = 1 \vee 0$	...	$A_{21,n} = 1 \vee 0$	<0,n>
		ΣA_i	<0,21>		<0,21>		<0,21>	

Inconsistencies in the Z-MESOT framework are featured in the last column in red, negative partial consistency is characterized by yellow and partial positive consistency is characterized by green. In regards to the total consistency of the PMS, then all the attributes in all of the rows have values equal to the number of analyzed parameters *n*, whichever is:

$$\text{If } \sum_{i=1,j=1}^{n,21} A_{i,j} = n \ \wedge j = <1, 21> \rightarrow \text{whole PMS consistency} \quad (4)$$

The sum of the individual columns can have a value between the interval 0 to 21. The more attributes there are defined for performance indicators, the more measurements and evaluations are systematic, and the more we can talk about systemic approach.

The main aim of this empirical research is to explore the levels of PMS consistency in selected enterprises. In order to achieve this goal we use data provided by Slovak enterprises via a survey, which was conducted in the period between October 2015 and April 2016. Our research sample file was created as a representative sample of the base file. We took into account the criterion of company's size. We focused our

research on large-sized enterprises, since we assume they have higher levels of PMS consistency. The decisive criterion was set according to the European Standard No. 96/280/EC. We also focused only on production enterprises. According to the Slovak Statistical Office at the time of our research there were 280 large-sized production enterprises. Moreover, we decided to take into account only those enterprises, which have implemented ISO 9001 quality standard. Therefore, our base file consists of 259 enterprises. During the research period, 97 enterprises were asked to participate on this research. Based on implemented performance indicators we selected 10 enterprises to be included in our sample file.

Data was collected during direct visits of these enterprises from their corporate documentations, interviews with corresponding managers and our own analysis.

4.2. Results and discussion

Application of the Z-MESOT framework in the first enterprise is shown in Figure 4. This application is used to verify the consistency of PMS in the selected manufacturing company. These 12 performance indicators were included in the testing of all enterprises:

1) PI_1: Marketing Return on Investment (MROI)
2) PI_2: Inventory Turnover (ITO)
3) PI_3: Debt to Equity Ratio (DER)
4) PI_4: Return on Equity (ROE)
5) PI_5: Net Profit Margin (NPM)
6) PI_6: Average cycle time (ACT)
7) PI_7: Units on time (UOT)
8) PI_8: DIFOT – Delivery In Full on Time (DIFT)
9) PI_9: TSMC – Total Supply Management Costs (TSMC)
10) PI_{10}: Overall Equipment Effectiveness (OEE)
11) PI_{11}: Number of customer complaints (NCC)
12) PI_{12}: Customer Satisfaction Index (CSI)

In our paper we do not analyze whether the indicators are suitable for measuring the overall performance. We analyze the consistency of their definitions using the Z-MESOT framework. Based on the analysis in the first selected company, we enter values 1 or 0 into the framework matrix depending on whether the attribute has been defined for that variable. We conducted an analysis of the controlling system, reviewed reports and conducted structured interviews with managers of the selected manufacturing company. Table 3 shows the results of the analysis achieved by the Z-MESOT framework. The company uses 12 key performance indicators form PI_1 to PI_{12}. In this case $i = 12$. The number of attributes of the performance indicator is unchanged, i.e. $j = 21$.

Table 3. Testing the consistent definition of PMS using the Z-MESOT framework. Own elaboration.

		1	2	3	4	5	6	7	8	9	10	11	12	
		MROI	ITO	DER	ROE	NPM	ACT	UOT	DIFT	TSMC	OEE	NCC	CSI	ΣA_{ij}
F1	Name of the PI	1	1	1	1	1	1	1	1	1	1	1	1	12
F2	Relationship to the business process	1	1	1	1	1	1	1	1	1	1	1	1	12
F3	Relationship to the strategic goal	1	1	1	1	1	1	0	0	0	0	0	0	6

F4	Strategic goal (name and mark of the strategic goal)	0	0	0	0	0	0	0	0	0	0	0	0	0
F5	Responsibility for the PI`s definition	1	0	0	1	1	0	0	1	1	1	1	0	7
T1	Responsibility for the target value definition	1	1	1	1	1	1	0	0	0	0	0	1	7
T2	Unit of the PI	1	1	1	1	1	1	1	1	1	1	1	1	12
T3	Period defined for the target value achievement	1	1	1	1	1	1	1	1	1	1	1	1	12
T4	Determinants of the target value definition	0	0	0	0	0	1	1	0	0	0	0	0	2
T5	Target value (number)	1	1	1	1	1	1	1	1	1	1	1	1	12
I1	Responsibility for data recording	1	1	1	1	1	0	0	0	0	1	1	1	8
I2	Frequency of data recording	1	1	1	1	0	0	0	1	1	0	0	1	7
I3	Place for data recording	1	1	1	1	1	1	0	0	0	1	1	0	8
I4	Source of data	1	1	1	1	1	1	1	1	1	1	1	1	12
I5	Calculation formula	1	1	1	1	1	1	1	1	1	1	1	1	12
I6	Automation of the calculation (manually/software)	1	1	1	1	1	1	1	1	1	1	1	1	12
E1	Responsibility for the PI`s evaluation	1	1	1	0	0	0	0	1	1	1	0	0	6
E2	Frequency of the PI`s evaluation	1	1	1	0	1	0	0	0	0	0	0	0	4
E3	Visualisation of the achieved performance	1	1	1	1	1	1	0	0	0	0	0	0	6
E4	Action in case of a performance gap	1	1	1	1	0	0	0	0	0	0	0	0	4
E5	Warning signal for the evaluator	1	1	1	1	0	0	0	0	0	0	0	0	4
	ΣA_j	19	18	18	17	15	13	9	11	11	12	11	11	

Firstly, we investigated the existence of a partial positive or negative consistency. As shown in Table 3, the positive consistent partial definition applies to all KPIs in the following attributes: F1, F2, T2, T3, T5, I4, I5 and I6. This means that key performance indicators used to evaluate the company's performance have not specified all the PI`s attributes ($j \neq 21$), but selected attributes are specified overall in these KPIs. It is a partial positive consistency of the PMS. These KPIs have a consistent definition, but the whole

PMS is inconsistent. If any of the following performance indicators had defined all other attributes, we could have talked about a completely consistent PMS. Our analysis, however, discovered that some indicators have also defined other attributes and vice versa, several do not. Thus, the sum of the last column shall be neither 0, nor 12.

In the case of the first analyzed company, we can therefore talk about an inconsistent PMS. A solution would be either to define attributes, F1, F2, T2, T3, T5, I4, I5, and I6 for the other indicators or omit the attributes which are defined only for certain parameters with the last column of this attribute acquiring the sum 0. The set of all attributes reaches a value of 21. In the last line we can see the degree of systemic approach in measuring and assessing a company's performance. A systematic approach is applied when the last line in each field is equal to the value 21, representing a definition of all attributes for all indicators.

Similarly we examined the PMS consistency in other nine enterprises. Table 4 and Table 5 provide summarized information about the state of PMS consistency of all analyzed enterprises.

Table 4. No. of enterprises structured by the levels of defined attributes to each indicator. Source: Own elaboration.

Indicator	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MROI	2	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ITO	0	5	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DER	0	4	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROE	0	0	2	1	4	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NPM	0	0	1	1	5	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ACT	0	1	1	1	2	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
UOT	0	2	1	0	1	1	2	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0
DIFT	1	0	1	0	1	2	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0
TSMC	0	0	1	1	0	0	4	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0
OEE	1	2	0	1	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
NCC	0	0	1	0	1	4	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CSI	0	0	2	2	3	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Table 4 provides information about the number of enterprises which have defined a certain number of attributes for given indicator. For example 2 enterprises have all 21 attributes defined for indicator MROI. Five enterprises have 20 attributes defined for this indicator and 3 enterprises have 19 attributes defined. Similarly we could describe the complexity of attribute definition for each indicator.

According to the data provided the most completely defined indicators are MROI, ITO and DER. On the other hand indicators with the least number of defined attributes are NCC, TSMC and NPM. These findings not only characterize which indicators are the most completely defined by their attributes, but moreover, they show us a baseline of how the situation is in the whole sample of Slovak large-sized production enterprises.

Table 5. No. of enterprises with the sum of defined attributes. Source: Own elaboration.

Attribute	12	11	10	9	8	7	6	5	4	3	2	1	0
F1	10	0	0	0	0	0	0	0	0	0	0	0	0
F2	5	0	0	0	4	1	0	0	0	0	0	0	0
F3	5	0	1	1	1	0	1	1	0	0	0	0	0
F4	3	0	1	5	0	0	0	0	0	0	0	0	1
F5	4	0	0	0	0	1	0	5	0	0	0	0	0
T1	5	4	0	0	0	1	0	0	0	0	0	0	0
T2	10	0	0	0	0	0	0	0	0	0	0	0	0
T3	8	1	1	0	0	0	0	0	0	0	0	0	0
T4	0	0	1	1	1	1	4	0	1	0	0	1	0
T5	10	0	0	0	0	0	0	0	0	0	0	0	0
I1	8	0	1	0	1	0	0	0	0	0	0	0	0
I2	3	0	1	5	0	1	0	0	0	0	0	0	0
I3	7	1	0	1	1	0	0	0	0	0	0	0	0
I4	10	0	0	0	0	0	0	0	0	0	0	0	0
I5	10	0	0	0	0	0	0	0	0	0	0	0	0
I6	10	0	0	0	0	0	0	0	0	0	0	0	0
E1	3	3	1	0	0	0	3	0	0	0	0	0	0
E2	0	0	0	1	0	0	2	0	7	0	0	0	0
E3	4	1	2	2	0	0	1	0	0	0	0	0	0
E4	0	0	1	0	3	2	2	0	1	0	0	0	1
E5	0	0	0	0	0	0	0	3	2	1	3	0	1

According to the data provided the most commonly defined attributes in selected enterprises are attributes F1, T2, T5, I4, I5 and I6. These 6 attributes were defined for all indicators in all enterprises. On the other hand the attributes that are not sufficiently defined are E5, E4 and E2.

We take a closer look on each analyzed enterprise. Figure 2 shows comparisons among levels of attribute definitions for the second, the third and the fourth enterprises.

The total sum of achieved points for each attribute is 12. According to the comparison it is obvious that this maximum level was achieved for attributes F1, F3, T2, T3, T5, I4, I5 and I6 for all three enterprises. On the other hand the lowest sums of points were marked for attributes E2, E5 and F5 by these companies. Therefore, in the case of the second, the third and the fourth analyzed companies, we can talk about an inconsistent PMS.

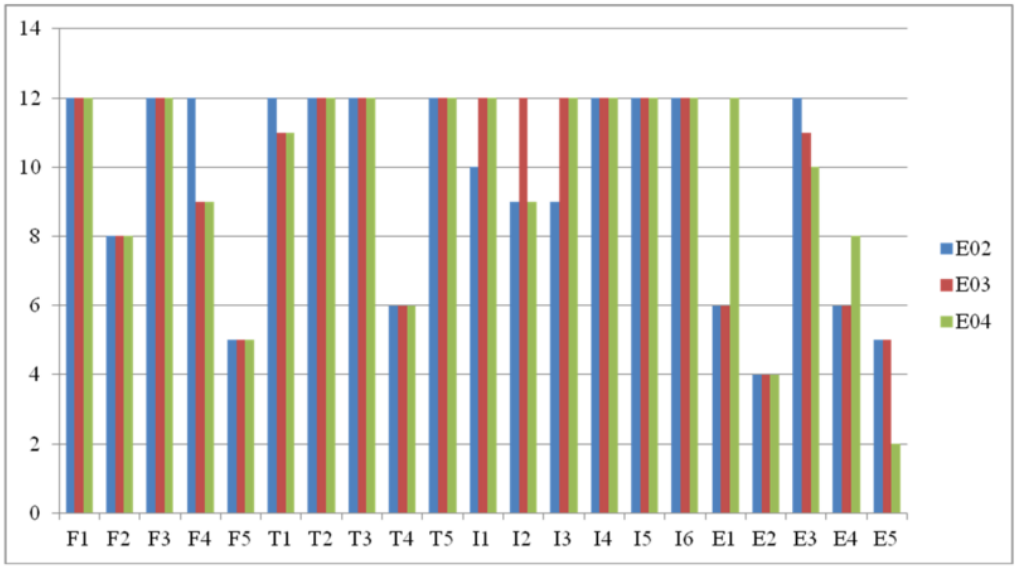


Figure 2. Testing the consistent definition of PMS using the Z-MESOT – E02, E03 and E04
Source: Own elaboration.

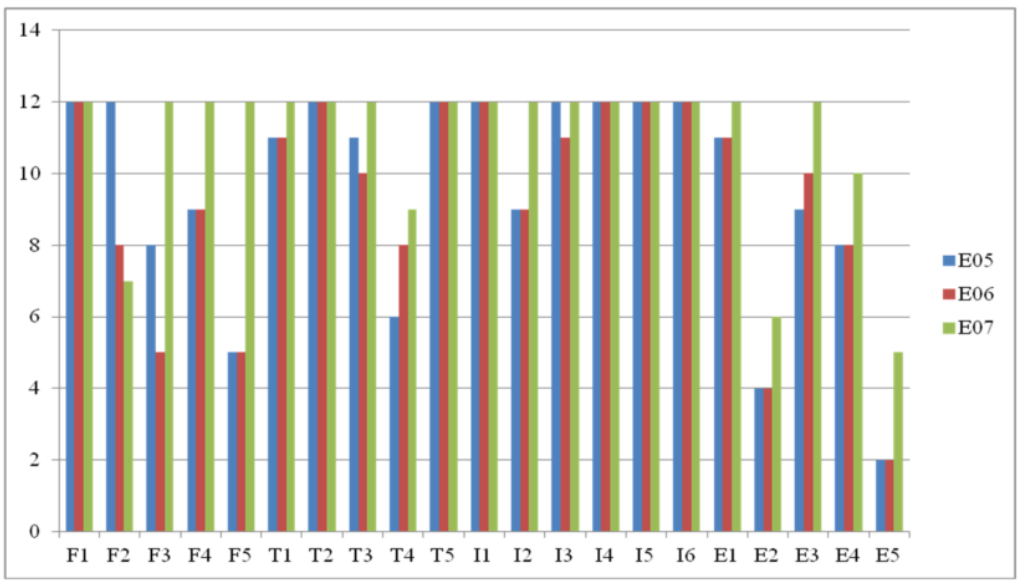


Figure 3. Testing the consistent definition of PMS using the Z-MESOT – E05, E06 and E07
Source: Own elaboration.

Figure 3 shows comparisons among levels of attribute definitions for the fifth, the sixth and the seventh enterprises. Our findings suggest that maximum level of 12 points was achieved for attributes F1, T2, T5, I1, I4, I5 and I6 for all three enterprises. The lowest sums of points were marked for attributes E5 and E2 by these companies. Therefore, in the case of the fifth, the sixth and the seventh analyzed companies, we can once again talk about an inconsistent PMS.

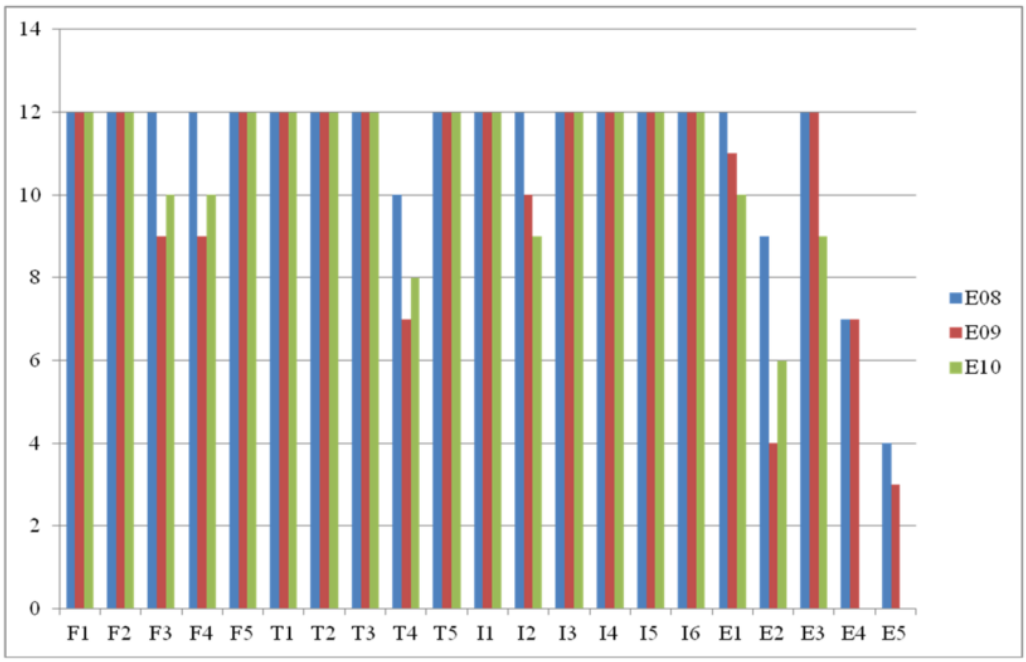


Figure 7. Testing the consistent definition of PMS using the Z-MESOT – E08, E09 and E10
Source: Own elaboration.

5. Conclusions

Maintaining the balance of enterprise as a social system depends on a consistent definition of its subsystems. Such subsystems also include a performance management system. The main purpose of our paper is to present the theoretical approach for testing a performance management system`s consistency by using the Z-MESOT framework. This framework is a summary of our previous research and an effort to develop an effective managerial tool for testing the PMS consistency. In the paper we also presented the results of an empirical study in ten selected manufacturing companies.

A company can be viewed from different perspectives. Each analysis can venture to define its required elements and identify significant relationships between them. Quality auditing defines the enterprise processes and the people allocated to them providing quality products. Marketing managers view a company through the marketing processes. Both may look at the same subject, but in other relationships with other processes or elements of the company's systems. If we were to define a company as a black box, it can be opened from different sides, and we can always see other context.

In our paper we tried to create an image of consistently defined PMS. This view does not lie in the creation of a set of specific performance indicators. Stakeholders, strategic, operational and employee performance level can each have a set of performance indicators. Some performance indicators may be common to different levels of performance. What is important is their consistent definition that is a prerequisite for the consistency of the whole PMS. By presenting the results of empirical study, we wanted to highlight few examples of specific chosen companies and their 12 KPIs and how the Z-MESOT framework can be used to test the consistency of PMS. Our results created a finding of partial positive consistency in most of the enterprises. since all indicators had

selected PI`s attributes defined. We even discovered a negative and partial consistency when all attributes had not defined one of the characteristics. Therefore PMS is not consistent as a whole in any of the examined enterprises.

The presented Z-MESOT framework can serve managers not only to test the consistency, but also to define the responsibility for measuring and evaluating business performance if individual indicators have specified various attributes.

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