

Kadak, Tarmo; Laitinen, Erkki K.

Article

How different are performance management systems? Empirical typology of performance management systems

Journal of Business Economics and Management (JBEM)

Provided in Cooperation with:

Vilnius Gediminas Technical University

Suggested Citation: Kadak, Tarmo; Laitinen, Erkki K. (2023) : How different are performance management systems? Empirical typology of performance management systems, Journal of Business Economics and Management (JBEM), ISSN 2029-4433, Vilnius Gediminas Technical University, Vilnius, Vol. 24, Iss. 2, pp. 368-386,
<https://doi.org/10.3846/jbem.2023.19248>

This Version is available at:

<https://hdl.handle.net/10419/317629>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

HOW DIFFERENT ARE PERFORMANCE MANAGEMENT SYSTEMS? EMPIRICAL TYPOLOGY OF PERFORMANCE MANAGEMENT SYSTEMS

Tarmo KADAK^{1*}, Erkki K. LAITINEN²

¹*Centre of Accounting, Department of Business Administration, School of Business and Governance,
Tallinn University of Technology, Ehitajate tee 5, 19086, Tallinn, Estonia*

²*ACA Research Group, School of Accounting and Finance, University of Vaasa,
P.O. Box 700, 65100, Vaasa, Finland*

Received 28 August 2022; accepted 19 May 2023

Abstract. The purpose of the research is to extract an empirical typology presenting the diverse types of PMSs. For creating empirical typology, a Two-Step cluster analysis was applied. The types of PMSs are characterized by the variables extracted from the chain model found in the literature. We discovered two relevant dimensions specifying the PMSs: the importance of strategy for the firms and the multitude of organizational levels. Based on these, we extracted four clusters (types) of PMS along the dimensions of strategy focusing and organizational level. The findings show that the most advanced PMSs are found in the Strategy-focused Multi-level cluster, before the Strategy-focused One-level cluster. We also linked the dimensions within the four aspects of PMSs: strategic, alignment and process, usage, and information aspects. We found that the expected success of PMSs is positively related to the strategy-focus and multiplicity of levels. These findings broaden the common typologies of PMS and add the intrinsic features of the firm to the types of PMS reflecting strategy orientation and the multitude of hierarchy levels of the firm.

Keywords: Performance Management Systems (PMS), cluster analysis, key success factors, clusters of PMS, hierarchy levels, strategy focus.

JEL Classification: M410, M1, M2.

Introduction

Contingency theory claims that there is no best way to organize a corporation, to lead a company, or to make decisions (Morgan, 2007). It suggests that the optimal course of action is contingent or dependent upon the internal and external situation of the company. Thus, contingency theory claims that also Performance Management Systems (PMSs) in business companies have been shaped based on the company's internal and external tensions and

*Corresponding author. E-mail: tarmo.kadak@ttu.ee

reflect differences in these tensions. If companies build a PMS that is not contingent upon these tensions, the system can fail and does not help the management measure and improve performance. Consequently, PMS should be built to match with the internal and external tensions to success leading improvement in performance. Since the internal and external situation of companies significantly varies, also the variations in PMSs can be large. It is not an easy task to build a PMS being a full match with the internal and external situation. Therefore, companies all around the world report mixed, either positive or negative, news of the success of PMSs (de Waal, 2018). Because of this mixed news, companies hesitate to invest on PMS although it can be a success story. If successful, PMSs can be considered as effective reactions to conceptual and practical calls faced by firms in changing world (Cuccurullo et al., 2016).

There are a countless number of PMS variations in companies depending on the variations in the internal and external tensions. However, we argue that there are only few archetypes of PMSs which are contingent upon the main characteristics of the tensions. We believe that the identification of these archetypes can help management understand the match between its own PMS and these tensions. The typology can give advice how to build a PMS to be successful in improving the performance of the organization. Thus, the objective of this study is to investigate empirically how the PMSs are used by companies differ with respect to the intrinsic characteristics and how these differences influence the performance of the organizations. The research setting is operationalized focusing on a search for a typology of PMSs and on analysing the differences between the extracted archetypes. The intrinsic characteristics of PMSs in this study are measured by the key factors (KFs) of PMS along different aspects of PMS. Therefore, this study concentrates on the following research questions (RQs):

RQ1: (a) What kinds of empirical archetypes of PMS exist in practice with respect to the key factors (KFs) of PMS? (b) How do these archetypes differ in emphasizing different aspects of PMS?

RQ2: How are these archetypes related to the expected success of PMSs?

We think that answering to these research questions will increase our understanding about the diversity of PMSs and how this diversity leads to differences in performance consequences. Therefore, we expect that the results will explain why the mixed results found in previous studies. In summary, we expect that our study will increase the general knowledge about the types and success of PMSs.

This study is organized so that the introduction, presents the motivation and objectives of the research. In the next section, relevant previous studies and the theoretical framework are shortly discussed. In the second section the empirical data and methods of the study are presented. The empirical part is based on a Two-Step cluster analysis applied to questionnaire data. The next section includes empirical findings and discusses the results on the typology extracted by the cluster analysis. The fourth section sums up findings to the research questions and highlights specific implications to theory and practice. Finally, the last section sums up the main results, discusses its limits and proposes cues for the next studies.

1. Theoretical framework

1.1. Principles of PMSs

PMS is a systematic approach to measure the performance of the organization and to use these results in management to improve efficiency and effectiveness. PMSs are considered as effective reactions to conceptual and practical calls faced by firms in changing world (Nudurupati et al., 2021; Cuccurullo et al., 2016; Choong, 2014; Hoque, 2004). However, research on PMSs also presents drawbacks associated with the implementation and use of PMSs (Couturier & Sklavounos, 2019; Choong, 2014; Taticchi et al., 2012; Bourne, 2008; Franco-Santos et al., 2007; Neely, 2005; Bourne et al., 2000). Moreover, different performance consequences of implemented PMSs are found mixed and contradicting (de Waal, 2018; Franco-Santos et al., 2012; Bedford et al., 2008; Yu et al., 2008; Neely, 2008; Davis & Albright, 2004; Malina & Selto, 2001).

The mixed evidence from PMSs has showed that there are both positive (Hoque, 2004; Hoque & James, 2000) and negative (Jazayeri & Scapens, 2008) performance consequences. Both types of consequences have found on similar conditions (manufacturing, large-size firms) and on the similar description of PMS (usage of non-financial measures). Thus, the use of a similarly defined PMS under similar circumstance can lead to contradicting impacts on non-financial performance. Similarly, some studies have reported positive (Crabtree & Debusk, 2008) and some studies negative (HassabElnaby et al., 2005; Said et al., 2003) consequences of PMS to financial performance. These contradicting results of these studies are also drawn for similar conditions (a wide range of industry firms), and PMSs are similarly described as using non-financial measures. Thus, empirical evidence on PMSs implicates that even on analogous conditions and similarly described PMSs the performance consequences can be contradicting.

The mixed evidence on PMSs has led to a confusing understanding of the success of PMSs. This kind of evidence shows that in spite of the similar broad description of a PMS, the intrinsic characteristics of the systems are different leading to either increasing or decreasing performance. These characteristics should fit the organizational variables of the firm to ensure positive consequences. Each organization needs to form its own PMS corresponding to its circumstances to succeed (Franco-Santos et al., 2012). Thus, in order to be useful, a PMS have to be accord in with the characteristics of the organization and its surroundings (Tangen, 2005). This obviously leads to a high variety of different PMSs in use as a response to different strategic initiatives of firms (Hope & Hope, 1995; Govindarajan & Shank, 1992; Miles & Snow, 1978).

There are some generally accepted principles about PMSs. These principles presented below focus on requirements and components which should be met to lead to efficient PMSs and, consequently, to a high organizational performance. These principles can be linked with the intrinsic characteristics of PMS in constructing a typology. The literature emphasizes that inside the PMS there should exist certain relations between the components (objectives, measures, actions and results). These relations are expressed in many ways. However, causality relations are preferred (Franco-Santos et al., 2012; Kaplan & Norton, 1992, 2006; Speckbacher et al., 2003). The goals must be in congruence with each other (Cuguero-Escofet & Rosanas,

2013). Anthony and Govindarajan (2003) regard the goal congruence as “the central purpose of a Management Control System”. Hall (2008), Kaplan and Norton (2006) and Vancil (1973) emphasize that the objectives of the firm and the managers should be aligned.

Performance measures should be derived from strategic objectives (Franco-Santos et al., 2012; Bourne et al., 2003; Cross & Lynch, 1992; Kaplan & Norton, 1992). The metric selection should contain output-related performance indicators as well as (leading) indicators (Lohman et al., 2004). The components of PMS should be hierarchical. The stages of PMS development generally consist of the design, implementation and the use of PMS (Cuguero-Escofet & Rosanas, 2013; Kadak, 2011; Bourne et al., 2000). The design stage of PMS is discussed by Ferreira and Otley (2009) and de Waal (2007), who have proposed detailed components for the design of a PMS. The components of PMSs should reflect the balance: there should be a balance between financial and non-financial, short-term and long-term measures (Cheng et al., 2007; Franco-Santos et al., 2007; Ittner et al., 2003; Kaplan & Norton, 1992).

The implementation stage is usually characterized by the resistance to introduce a new PMS (Meekings, 1995). Eccles (1991) argues that there are three important factors for the successful implementation of a PMS: developing an information architecture with supporting technology; aligning incentives with the new measurement system, and the lead given by the CEO. For the usage stage, Franco and Bourne (2003) point out components of PMS framework that facilitate the use of PMS: the management leadership and commitment; compensation link to PMS; communication and reporting; review and update of the PMS; and the PMS framework itself. Simons (1995) points out the importance of using PMSs interactively and diagnostically.

1.2. Previous typologies

Typologies are important in increasing our understanding of the diversity of PMSs. However, there are only few studies with the purpose of creating PMS typologies. Alach (2016) proposed a standard conceptual typology of performance measurement including four generic elements with sub-elements: 1) Levels (outcomes, impacts, outputs, processes, inputs); 2) Measures (quantity, quality); 3) Targets and 4) Actuals. Folan and Browne (2005) dichotomised performance measurement frameworks into structural and procedural typology. Speckbacher et al. (2003) introduced a typology that covers BSCs. Their first type contains financial and non-financial strategic performance measures grouped into perspectives. The second type additionally employs a specific approach to describe the organization's strategy using a sequential cause-and-effect logic to link tangible and intangible assets. The third type includes an additional feature, which makes the incentive pay contingent on the performance results of the scorecard measures.

Furthermore, Franco-Santos et al. (2012) presented a four-type typology in which PMSs are defined by the components and by the consequences of PMS. In this typology, all four types include financial as well as non-financial performance measures as components implicitly or explicitly linked to strategy and are used to inform managerial decision-making and to evaluate organizational performance. In addition, in the second type, PMS is showing explicit cause-and-effect relationships among the measures as a component. In the third type, PMSs

for the use are not linked with the performance evaluation results to monetary rewards. In the fourth type, PMS for the use influences monetary rewards.

In summary, these PMS typologies are purely conceptual and are not reflected by any empirical data of PMSs. Therefore, there is a keen need for developing data-based, empirical typologies of PMSs using the intrinsic characteristics of the systems.

1.3. Development stages of PMSs

The implementation of a PMS is a long-term process and during it the PMS evolves continuously. The differences between newly created PMSs and PMSs that have been used for years can be significant. Tangen (2005) sees this as a development process of a PMS. He suggests that the firm should start with designing the lowest level of a PMS. Later when the firm is completely prepared it should progress to the next level and then to the highest level. It takes time to develop a PMS as well as that an organization needs to build up experience in performance measurement before being able to handle an advanced PMS. Hurrying may have negative consequences, an impatient firm that directly attempts to reach the highest level of a PMS will probably fail. Each level has its period of experimentation and learning before being fully embedded into the organization (Tangen, 2005). Speckbacher et al. (2003), Franco-Santos et al. (2012) and Tangen (2005) also proposed levels on PMSs in different development stages.

To sum up, factors and features, which currently define most highest-level and efficient PMSs are: the existence of financial and non-financial measures in the PMS; how these measures are linked with strategy; on which time horizon and what kind of performance PMSs are focusing (what PMSs help achieve); about the existence of causality between measures and/or relationship; and the existence of linkage with an incentive reward system and to whom the PMS provides information; PMSs are used interactively and diagnostically. The levels of PMS show, there are PMSs in practice with different maturity stages. However, the levels do not reveal the critical components of a PMS that are connected with the success of the PMS. Therefore, in response to the RQs the so-called chain model of PMS that is based on the check points (CPs) of KFs as critical components will be used in the empirical part to highlight the structure of PMS.

1.4. Chain of KFs in PMS

We think that the most useful typology of PMSs can be created using the key factors (KFs) to reflect the intrinsic characteristics of the PMSs. Therefore, we briefly summarize the so-called chain model of PMS success, which forms the main part of the theoretical background for the variables used here to extract the typology. Kadak and Laitinen (2016a) created this approach to evaluate the success of a PMS, based on a logical chain of KFs. The KFs of logical chain have relations with strategy and causal relations within the PMS, which theoretically impact the effectiveness of a PMS (Battesini et al., 2021; Irfani et al., 2020; Sardi et al., 2020; Yu et al., 2008; Kaplan & Norton, 2001, 1996). These KFs also consider incentive systems and multiple levels of the organization playing an important role in PMSs (Franco-Santos

et al., 2012; Bedford et al., 2008). The idea of the framework consists of the approach where PMS is as a logical chain of check points (CPs) where each KF (represented by a CP score) is ranked between 0 (not existing) and 1 (existing).

In the chain model, fourteen KFs form a holistic logical chain. Because the success of a PMS is based on the completeness of the logical chain, in a perfect PMS as many KFs as possible should be present (KF: 1; on which means that this Key Factor is implemented in the PMS of the company) in PMS. In an extreme case, even one missing KF (KF: 0; KF is missing) in the chain can significantly weaken the performance of the PMS. The chain of the existing KFs should be as entire as possible to make it potential for a PMS to be successful. Consequently, the performance or (expected) success rate of PMS depends on the strength of the logical chain that can change on a scale from weak to excellent. However, Kadak and Laitinen (2016a) presented that the score of the chain, the pure number of the existing KFs, reflects efficiently a PMS's success. Table 1 includes the fourteen KFs and fifteen CPs which form the variables for searching the typology.

Table 1. Descriptions of the 14 key factors (KFs) and 15 check points (CPs) of PMS of framework (Kadak & Laitinen, 2016a) and CPs mean values by clusters.

No of KF	No of CP	Descriptions of variables	Clusters:				F-test	p-value
			S-M	S-1	NS-M	NS-1		
1	1	MIS: Firm has a stated mission (it is documented in a written form) (1/0).	0.950	1.000	0.714	0.313	21.88	0.00000
2	2	STR: Firm has a document describing corporate strategy (it is documented in a written form) (1/0).	1.000	0.824	0.286	0.125	63.59	0.00000
3	3	CSF: Firm's strategy document (map) includes descriptions of causal relationships between Critical Success Factors (CSFs) (1/0).	0.417	0.412	0.143	0.000	4.677	0.00419
4	4	STROBJ: Corporate strategy document includes a description of corporate firm-level objectives (1/0).	1.000	1.000	0.000	0.000	n.a.	n.a.
5	5	ORGKPI: Corporate PMS includes a set of firm-level performance measures (1/0).	0.933	0.824	0.857	0.375	11.65	0.00000
6	6	UNOBJ: Firm has goals set on different hierarchical levels of the firm (1/0).	1.000	0.000	1.000	0.000	n.a.	n.a.
7	7	UNKPI: Firm has a set of performance measures on different levels of organization (1/0).	0.933	0.353	0.857	0.250	24.53	0.00000
8	8	KPR: Firm has defined key processes (1/0).	0.867	0.824	0.571	0.375	7.463	0.00014

End of Table 1

No of KF	No of CP	Descriptions of variables	Clusters:				F-test	p-value
			S-M	S-1	NS-M	NS-1		
9	9	IMPL: PMS of firm was built and designed with the users of this system (Likert 7-scale, assess on a scale from 1 = does not agree at all to 7 = agree perfectly).	0.614	0.618	0.524	0.406	2.61	0.05545
10	10	ACTUSE: PMS of firm is used interactively where managers are constantly and personally discussing with subordinates to learn strategic uncertainties and involved subordinates decisions (Likert 7-scale).	0.644	0.529	0.631	0.438	3.573	0.01659
	11	DNGUSE: PMS of firm is used diagnostically where managers monitor organizational outcomes and correct deviations from present standards of performance (Likert 7-scale).	0.683	0.667	0.631	0.448	4.939	0.00303
11	12	PMS of firm is intensively used by employees in charge (users of the system) (Likert 7-scale).	0.647	0.510	0.607	0.385	5.947	0.00088
12	13	INSYS: PMS of firm is associated with an incentive system to motivate employees towards achievement of objectives (1/0).	0.850	0.650	0.790	0.130	14.91	0.00000
13	14	QUALINF: PMS of firm produces valid, reliable, timely and usable information for managerial work (Likert 7-scale).	0.678	0.588	0.631	0.479	3.089	0.03041
14	15	ADJ: PMS of firm is systematically updated when changes in organization or environment are emerged (1/0).	0.800	0.647	0.786	0.188	9.241	0.00000
		Sum variable	12.017	9.446	9.028	3.912	22.217	0.00000

Kadak and Laitinen hypothesized that the stronger the chain, the higher is the probability of success in PMS implementation. The strength of the chain was empirically measured by the distribution of the values of CPs (0–1). Their empirical findings strongly supported the proposed framework and the strength of the chain as a predictor of a PMS success. The chain approach can be considered contemporary as it includes the elements and features of contemporary PMSs: 1) a PMS uses financial and non-financial performance measures (Cheng et al., 2007; Franco-Santos et al., 2007; Ittner et al., 2003); 2) translates business strategies into deliverable results (Hall, 2008); 3) aligns management processes, such as target setting,

decision-making, and performance evaluation, with the achievement of chosen strategic objectives (Matos et al., 2019; Ittner et al., 2003); and 4) adopts diverse key performance indicators (KPIs) and the KPIs are linked to the organization's business strategy (Matos et al., 2019; Franco-Santos et al., 2012). The chain model has been used as a framework for analysing the formality of PMSs (Kadak & Laitinen, 2016b) and the success of PMSs (Laitinen & Kadak, 2019). In this study, the KFs of the chain model will be used to extract the typology of PMS. In addition, the score of the chain model will act as a measure of a PMS's expected success.

2. Empirical data and methods

2.1. Sample of firms

PMSs are employed by firms from each size class and industry. Thus, in order to extract a representative typology of PMSs, the data available should be taken from very different kinds of firms to ensure diversity. Therefore, the data for empirical analysis was drawn from a sample randomly extracted from a wide and representative population of Finnish and Estonian firms. The data was gathered using an internet questionnaire organized at the same time in Estonia and Finland. Thus, the data was obtained from firms of different industries (for example (from total) manufacturing (30%), services (31%), trading (15%), other (24%: utilities, logistics, construction, communication)) and of different size (small, medium, and large-size). Two countries were chosen due to similarities of business environment, of the same size proportions and overall culture, history of both countries.

In both countries, the sample of firms was randomly selected. For that, in Estonia, email addresses of 500 Estonian firms were selected from different sources and an invitation to respond was sent on a random basis to the top manager of the firm (CEOs or CFOs). 57 managers responded to the survey, which makes a response rate of over 10%. In Finland, the email addresses of Finnish managers close to 700 firms from a wide variety of industries was got on a random basis from Finland Marketing Register Ltd. However, 189 addresses had to drop due to technical issues. Then, after follow-up emails, 50 managers responded to the questionnaire (about 10% of the target sample). Finally, we had responses from a sample of 107 Estonian and Finnish firms. In all, 43% from 107 respondents were small (less than 50 employees), 42% medium (50–249 employees) and 15% large-size firms (250+ employees). A sample bias test was realized during follow-up calls. They showed only variances of little relevance in PMSs between the firms who responded and who did not respond. However, we think that the sample size is quite small which arises a call for future studies with larger groups of respondents.

2.2. Questionnaire

The fourteen KFs (15 CPs) of the chain-model framework were measured by the questions presented in Table 1. In the questionnaire, the respondents got a short description of each CP to facilitate responding. The questions were formulated as easy to respond as possible. In all, ten of the separate questions were measured on a binary on/off scale (0 or 1) while five questions were presented along a Likert scale from 1 (strongly disagree) to 7 (strongly agree). The

Table 2. Correlation coefficients between KFs of PMS

	MIS	STR	CSF	STROBJ	ORGKPI	UNOBJ	UNKPI	KPR	IMPL	USE	RESP	INSYS	QUALINF	ADJ
MIS	1													
STR	0.54	1												
CSF	0.25	0.30	1											
STROBJ	0.55	0.79	0.34	1										
ORGKPI	0.38	0.41	0.26	0.36	1									
UNOBJ	0.29	0.40	0.15	0.30	0.38	1								
UNKPI	0.34	0.37	0.15	0.27	0.38	0.64	1							
KPR	0.37	0.41	0.26	0.40	0.29	0.22	0.28	1						
IMPL	0.16	0.22	0.17	0.24	0.36	0.13	0.23	0.39	1					
USE	0.21	0.26	0.17	0.24	0.43	0.28	0.37	0.35	0.52	1				
RESP	0.15	0.28	0.20	0.23	0.45	0.35	0.33	0.44	0.43	0.75	1			
INSYS	0.31	0.37	0.18	0.36	0.34	0.45	0.43	0.33	0.16	0.37	0.36	1		
QUALINF	0.15	0.22	0.20	0.20	0.46	0.25	0.19	0.26	0.40	0.74	0.66	0.30	1	
ADJ	0.34	0.25	0.16	0.29	0.47	0.37	0.26	0.25	0.38	0.36	0.43	0.47	0.51	1

values of the questions were made comparable standardizing the five Likert questions onto a range from 0 to 1 using a transformation of $(\text{value}-1)/6$. Then, the fifteen standardized CP variables were employed in the statistical analysis to cluster the sample firms into different groups or types to extract an empirical typology of PMSs. Correlation coefficients between KFs of PMS vary between 0.13–0.79, these are presented in Table 2.

2.3. Clustering

The objective of the statistical analysis was to find statistically representative types (groups) of PMSs and, thus, create an empirical typology. In this kind of segmentation research, the cluster analysis is the appropriate method (Benabdellah et al., 2019). The Two-Step Cluster Analysis (T-SCA) was in this study to extract the clusters due its useful characteristics (SPSS Inc., 2001). T-SCA is a hierarchical method designed to find natural groupings (or clusters) within a set of data that would otherwise not be apparent. The algorithm identifies groups of cases with similar response patterns. Cluster membership is then determined by the distance of the case to the closest cluster. The algorithm follows two steps: pre-clustering and hierarchical clustering. The first step clusters the cases into several small clusters. The second step groups small clusters into larger clusters. T-SCA selects the optimal number of clusters for the given set of the input variables. It can use continuous and categorical variables in clustering.

In this study, the clustering in SPSS was carried out using the following fifteen PMS CP variables as clustering (input) variables (see Table 1 for abbreviations):

1. The categorical input variables (0 or 1): MIS, STR, CSF, STROBJ, ORGKPI, UNOBJ, UNKPI, KPR, INSYS, ADJ
2. The continuous input variables (from 0 to 1): IMPL, ACTUSE, DNGUSE, RESP, QUALINF

In this study, T-SCA was a useful statistical tool, since CP variables include both categorical and continuous variables. It was also useful in finding the optimal number of clusters.

For RQ1, the relationships between the extracted types of PMSs and the CP variables is analysed using the means of the variables by clusters. The F-test is used to describe statistically the variances in the CP variables between the clusters. T-SCA is closely associated with the means of the variables, since the cluster centres are based on these mean values. Therefore, the variances in the CP variables between the clusters are tested using the F statistics. However, these tests are mainly used only for descriptive purposes because the clusters have been chosen to maximize the differences between the firms in different clusters.

For RQ2, the expected success of PMSs is measured by the average sum of the CP variables in each cluster. We think that the construct validity is good in the given analysis since the clustering variables form a theoretically defined set (chain) of CPs which determine the critical characteristics of PMS success. For comparison, we used several traditional clustering methods (K-means and hierarchical algorithms in SPSS) and compared the results with those obtained by T-SCA. For these methods, almost similar groupings were found supporting the generality of the results.

3. Analysis of clusters

3.1. Extraction of the clusters

T-SCA suggested four clusters as the optimal number of clusters and extracted a four-cluster typology for the PMSs. The means of CP variables implicate that the most significant variances in the variables between the four clusters are related with two dimensions: the importance of strategy and the number of organizational or hierarchical levels in the PMS. Therefore, we can classify and entitle the clusters in the following way:

- A. Strategy-focused PMSs

1. Multi-level PMSs (S-M) (51.4%)

2. One-level PMSs (S-1) (22.4%)
- B. Not-strategy-focused PMSs

3. Multi-level PMSs (NS-M) (10.3%)

4. One-level PMSs (NS-1) (15.9%)

This grouping shows that more than half of the firms (51.4%) belong to the cluster of strategy-focused multi-level PMSs (S-M). For multi-level PMSs, strategy-focusing is popular, since only a small portion of firms (10.3%) belong to the cluster of multi-level not-strategy-focused PMSs (NS-M). For one-level PMSs, the differences in the frequency of strategy-focused (S-1) and not-strategy-focused (NS-1) PMSs are relatively small (22.4% versus 15.9%).

3.2. Check Point (CP) variables

Table 1 summarizes the means and F-test results of the CP variables by clusters in response to RQ1a. The differences in the cluster centres (mean values) are also demonstrated graphically in Figure 1. The differences in means between the clusters are almost all statistically significant. The mission (MIS) and the strategy (STR) have been clearly expressed and aligned more often in Strategy-focused clusters than in others. Similarly, the firms in these clusters have more often PMS based on the causal relationships between Critical Success Factors (CFS). This finding is logical, since CFSs support and complement the understanding of the strategy and the mission. Consequently, none of the firms in Not-strategy-focused clusters has clearly stated corporate organization-level objectives (STROBJ) whereas all firms in Strategy-focused clusters have done so. Moreover, organization-level performance measures form a comprehensive set (ORGKPI) only very rarely in firms from the cluster NS-1.

Naturally, the delegation of STROBJs to each hierarchical level of the organization (UNOBJ) is done by all firms from multi-level clusters but none from the One-level clusters.

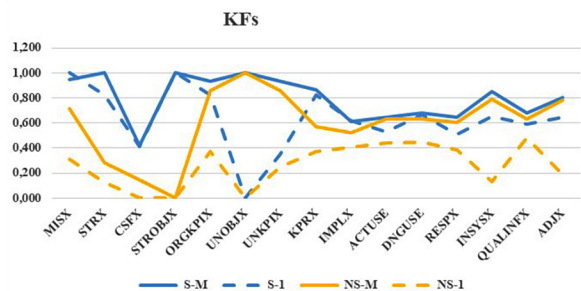


Figure 1. Means of the fifteen check point (CP) variables in the four clusters

Consequently, any use of performance measures in lower organization levels is rare for PMSs in One-level clusters. The identification of key processes (KPR) that is critical to attain STROBJs, is more often carried out in Strategy-focused clusters. Similarly, PMSs are more often designed and implemented interactively with the users (IMPL) in Strategy-focused clusters, but the differences between the clusters are not very significant. The styles to use PMS interactively (ACTUSE) or diagnostically (DNGUSE) are quite equally popular in all clusters except for NS-1, where both styles are rarer. These results are consistent with the intensive usage of PMS (RESP) and also with the association of an incentive system (INSYS) which both are only rarely presented in NS-1.

Interactive use of PMS is more popular in Multi-level clusters and diagnostic use is more applicable in Strategy-focused clusters having most sophisticated PMSs. This is opposite to the findings by Guenther and Heinicke (2019), who found that sophisticated PMSs negatively moderate relations between the diagnostic use and PMS benefits. The usage intensity of PMS is based on the perceived usefulness of PMS by responsible employees, and it reflects also the degree how much input information into the incentive system comes from the PMS. The low usage of PMS in NS-1 reflects that PMSs do not often produce valid and reliable information timely (QUALINF) and causes that PMSs are only seldom updated (ADJ). The last check points of PMS (RESP, INSYS, QUALINF, and ADJ) are all fulfilled more often in Multi-level clusters than in One-level clusters.

The chain theory implicates that if the values of CPs in PMS are high, then the chain is strong as a whole (measured by the sum of CPs) which makes the PMS successful, since firms with strong chain tend to have higher performance (Kadak & Laitinen, 2016a). Thus, according to the chain theory and its evidence the strength of the chain of CPs reflects the probability of success of a PMS making it possible to respond to RQ2. The sum of CPs (score) is highest in the S-M, next highest Figure 2. Means of the four aspects of PMS in the four clusters

in S-1 and lowest in the NS-1. The highest score indicates that in spite of the potential complexity of PMS, it however, serves these firms efficiently and successfully. The lowest sum of CPs in the NS-1 reflects the lowest demands of strategy and organizational level issues to PMS. However, PMSs of firms acting in this cluster also have to serve the functions of these firms although the probability of success is very low compared with PMSs from the other clusters.

3.3. Balance of aspects of PMS

The analysis of all fifteen CPs separately may give a fragmented insight of the differences between the clusters. Therefore, we summed up the CPs associated with similar aspects of PMS and got four rough classes of CPs as a response to RQ1b. Thus, according to their content, the classes describe the following aspects of PMS:

Strategy-focus. CPs (MIS, STR, CSE, STROBJ, and ORGKPI) ensure that the mission and the strategy are clearly expressed at the organization level, equipped with directing success factors, strategic objectives, and appropriate performance measures.

Alignment and process focus. CPs (UNOBJ, UNKPI, and KPR) assure the alignment of objectives and measures from the organizational level to the executing unit level and ensure that these were translated into necessary activities.

Usage. CPs (IMPL, ACTUSE, and DNGUSE) ensure that a PMS has designed, implemented and used repeatedly interactively and diagnostically by the users of the PMS.

Information. CPs (RESP, INSYS, QUALINF, and ADJ) ensure that information provided by a PMS is intensively used by employees in charge, that a PMS gives input into the incentive system, generates valid and reliable information to users on time and in a useful form, and that a PMS is continuously updated for changes in the organization and its surrounding environment.

Table 3 presents the means, proportions and F-test results for the four integrated aspects (classes) of CPs and their balance by clusters. The variances between the clusters are all statistically significant. The variances in the cluster centres (mean values) are also demonstrated graphically in Figure 2.

Table 3. Means and percentages of the four aspects of PMS by clusters

Aspects of PMS/ Clusters	S-M		S-1		NS-M		NS-1		F-test	p-value
	Mean	%	Mean	%	Mean	%	Mean	%		
Organization level strategy-focus	4.300	35.8	4.060	43.0	2.000	22.1	0.813	20.8	87.76	0.00000
Alignment & Process	2.800	23.2	1.177	12.5	2.428	26.9	0.625	16.0	74.39	0.00000
Usage	1.942	16.2	1.814	19.2	1.786	19.8	1.292	33.0	9.618	0.00000
Information	2.975	24.8	2.395	25.3	2.814	31.2	1.183	30.2	3.747	0.01116
Sum variable	12.017	100.0	9.446	100.0	9.028	100.0	3.912	100.0	22.217	0.00000

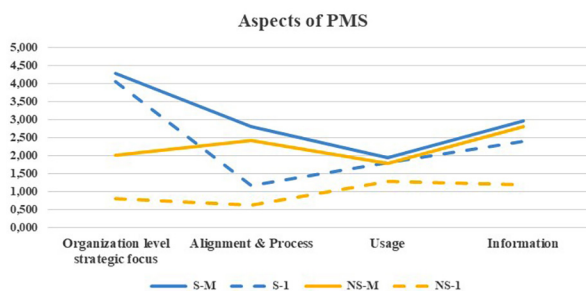


Figure 2. Means of the four aspects of PMS in the four clusters

Firstly, the results clearly confirm that Strategy-focus aspects are more powerfully presented in Strategy-focused clusters and secondly, Alignment and process focus aspects are more powerfully presented in Multi-level clusters. This finding supports the clustering results that focusing on the strategy, having more hierarchy levels, and having more precisely defined processes are reflected also in PMSs. Thirdly, the Usage aspects in PMS are almost evenly stressed in the Strategy-focused clusters and in the Not-strategy-focused clusters. The lowest Usage aspects of PMS are found in NS-1. Fourthly, Information aspects are most presented in

Multi-level clusters and least in NS-1 being consistent with the low usage of PMSs. In summary, these results obviously indicate the need to get high quality information to coordinate objectives and tasks between different levels and units.

In addition to the absolute values, the relative values (% in Table 3) of aspects inside each cluster give additional insight into their relative importance in PMS types and how aspects of PMS are balanced in each cluster. In the Strategy-focused clusters, the Strategic focus aspect logically shows the highest proportions receiving the relatively highest attention in these clusters, while its proportions are the lowest in the Not-strategy-focused clusters. This relation indicates that if firms are focusing more on strategy and its execution, then their PMSs are also constructed to support these issues. The Alignment and process focus aspect logically covers a higher proportion in the PMS of Multi-level clusters than in One-level clusters. This result shows the obvious relation that if a firm has a more complicated structure and more hierarchy levels, then the Alignment and process aspect is also strongly reflected in PMS. However, One-level cluster firms obviously have not considered it important to keep this aspect in PMSs strong. Because the firms in the Strategy-focused clusters show high proportions to the Strategic-focus aspect, the proportions of the Usage and Information aspects are consequently lower than in Not-Strategy-focused clusters.

4. Discussions

This study efforts to answer the research question (RQ1) on what types of PMSs exist and what kind of intrinsic characteristics dominate inside PMSs. The findings may open a new discussion for explaining how to design efficient PMSs. For this purpose, the research offers a novel ground for PMS research, firstly, by extracting the empirical types of PMSs, and secondly, analysing the differences between these types. Based on the CPs of PMS as input variables for clustering, the extracted statistical clusters are very authentic with real types of PMSs in practice and are valid irrespective of PMS formality levels. With these clusters, we showed that the extracted typology of PMS is based on such aspects as how powerfully the PMS is strategically focused and multi-layered throughout the organization. Consequently, the basic types of PMS differ with respect to these two main organizational characteristics, leading to a four-cluster solution: 1) Strategy-focused Multi-level PMS, 2) Strategy-focused One-level PMS, 3) Not-strategy-focused Multi-level PMS, and, finally, 4) Not-strategy-focused One-level PMS.

The findings provided also an answer to the second research question (RQ2). The sum of CP variables, “score”, which reflects the probability for a successful PMS, is the highest in S-M and the lowest in NS-1. With these findings we broaden current typologies of PMS. Previous studies on the typology of PMS have presented typologies which are purely conceptual and are not reflected by empirical data of PMSs. Our study was carried out to fill the gaps in research by developing a data-based, empirical typology of PMSs using the intrinsic characteristic of the systems. However, our study was also based on theoretical grounds using the CPs of the chain model as clustering variables. In this way, it was possible to find a typology which can be theoretically interpreted and justified. Thus, our study is novel in using the theoretically defined characteristics of PMSs to extract a generic typology.

With respect to the empirical studies in PMSs, we think that our study gives advice how to explain the contradicting results on PMS success (Jukka, 2023; Franco-Santos et al., 2012; Bedford et al., 2008; Yu et al., 2008; Neely, 2008; Davis & Albright, 2004; Malina & Selto, 2001). We think that the success of PMSs is a consequence of deep strategy-focusing and consequently, unsuccessful PMSs are too loosely connected with the strategy of the organization. This means, the characteristics of the PMS impact the success of PMS more than contingency factors potentially do. Technically, successful and unsuccessful PMS can look very similar although there are differences in strategy-focus. Furthermore, our results imply that the multiplicity of hierarchic levels is also important for success. Multiplicity refers to challenging structures of an organization which are difficult to control and manage without an efficient PMS. In one-level systems, the effectiveness of a PMS is not as clear. Thus, technically similar PMSs may lead to different success if they differ with respect to the multiplicity of levels.

Conclusions

The purpose of this study was to extract empirically a typology of PMS and show the relationships between the types and the success of PMS. The framework of the study was based on the chain model. This framework gave us a strong theoretical ground to select the variables describing the intrinsic characteristics of PMS. We used these fifteen CPs (questions) to cluster PMSs in a small sample of firms into clusters describing the dimensions of the typology. Extracted clusters enabled us to get insight how CPs of PMSs differ between clusters. The dimensions of the extracted typology were associated with strategy-focusing and multiplicity of hierarchical levels in PSM. On the basis of these dimensions, four clusters were extracted: 1) Strategy-focused Multi-level PMS, 2) Strategy-focused One-level PMS, 3) Not-strategy-focused Multi-level PMS, and 4) Not-strategy-focused One-level PMS.

The total sum of CP variables (score), which reflects the probability for a successful PMS, is the highest in the Strategy-focused Multi-level cluster and the lowest in the Not-strategy-focused One-level cluster. Thus, the expected success of a PMS is positively related to the strategy-focus but also the multiplicity of hierarchical levels in the PMS. We also classified the fifteen CPs according to their content into four rough classes, which deal with the following aspects in PMS: 1) Strategy-focus, 2) Alignment and process focusing, 3) Usage, and 4) Information. The results clearly confirm that Strategy aspects are more powerfully emphasized in Strategy-focused than in Not-strategy-focused clusters. Alignment and process aspects are more powerful in Multi-level than One-level clusters. Usage aspects in PMS are almost evenly presented in the Strategy-focused clusters and in the Not-strategy-focused Multi-level cluster. Information aspects are most stressed in Multi-level clusters and least in the Not-strategy-focused One-level cluster being consistent with the low usage of PMSs.

The results of this study show that the CPs of PMS differ between different types of PMS. These clustering results help us to understand the mixed and contradictory consequences of PMS implementations. If the PMSs differ with respect to the components of the CP chain, then also the probabilities of success differ from each other. When assessing the performance of a PMS, it is important firstly to check how strongly it supports the execution of

the organization-level strategy and performance management at different organization levels. Moreover, also Usage and Information aspects can prove as important to the success of a PMS. To summarize, strategy-focus and the multiplicity of hierarchical levels are the main factors in PMS classification and also the main drivers for success.

This study concentrated on the analysis of the extracted clusters using only the CPs of the PMS. In future research, it would be relevant to analyse the clusters with respect to organizational performances and the external and internal contingency factors, such as size, perceived environmental uncertainty (PEU), and strategies. It is expected that these factors also affect the probability of a PMS to success according to the contingency theory, which in turn opens a new insight how to design more personalized PMSs, increasing the efficiency of PMSs. This study is also limited by a small sample size. In the future, larger samples should be used to confirm the findings. Therefore, the results of this study should be considered still preliminary. However, we suggest that also useful case studies should be conducted to get deeper insights into different PMS. It would be interesting to choose case firms from every four cells of the typology and assess PMSs in these cells in detail. We also suggest that PMS from different countries should be compared with this framework. In this study, Estonian and Finnish firms are pooled in the same sample. Finally, future research should also pay attention to deepening the theoretical grounds of PMSs.

References

- Alach, Z. (2016). Toward a standard conceptual typology of public sector performance measurement. *Kōtuitui: New Zealand Journal of Social Sciences Online*, 12(1), 56–69. <https://doi.org/10.1080/1177083X.2016.1225579>
- Anthony, R. N., & Govindarajan, V. (2003). *Management control systems*. McGraw-Hill.
- Battesini, M., ten Caten, C. S., & de Jesus Pacheco, D. A. (2021). Key factors for operational performance in manufacturing systems: Conceptual model, systematic literature review and implications. *Journal of Manufacturing Systems*, 60, 265–282. <https://doi.org/10.1016/j.jmsy.2021.06.005>
- Bedford, D., Brown, D. A., Malmi, T., & Sivabalan, P. (2008). Balanced scorecard design and performance impacts: Some Australian evidence. *Journal of Applied Management Accounting Research*, 6, 17–36.
- Benabdellah, A. C., Benghabrit, A., & Bouhaddou, I. (2019). A survey of clustering algorithms for an industrial context. *Procedia Computer Science*, 148, 291–302. <https://doi.org/10.1016/j.procs.2019.01.022>
- Bourne, M. C. (2008). Performance measurement: Learning from the past and projecting the future. *Measuring Business Excellence*, 12(4), 67–72. <https://doi.org/10.1108/13683040810919971>
- Bourne, M. C., Franco, M., & Wilkes, J. (2003). Corporate performance management. *Measuring Business Excellence*, 7(3), 15–21. <https://doi.org/10.1108/13683040310496462>
- Bourne, M. C., Mills, J. F., Wilcox, M., Neely, A. D., & Platts, K. W. (2000). Designing, implementing and updating performance measurement systems. *International Journal of Operations and Production management*, 20(7), 754–771. <https://doi.org/10.1108/01443570010330739>
- Cheng, M. M., Luckett, P. F., & Mahama, H. (2007). Effect of perceived conflict among multiple performance goals and goal difficulty on task performance. *Accounting and Finance*, 47(2), 221–242. <https://doi.org/10.1111/j.1467-629X.2007.00215.x>

- Choong, K. K. (2014). The fundamentals of performance measurement systems: A systematic approach to theory and a research agenda. *International Journal of Productivity and Performance Management*, 63(7), 879–922. <https://doi.org/10.1108/IJPPM-01-2013-0015>
- Couturier, J., & Sklavounos, N. (2019). Performance dialogue: A framework to enhance the effectiveness of performance measurement systems. *International Journal of Productivity and Performance Management*, 68(4), 699–720. <https://doi.org/10.1108/IJPPM-09-2017-0238>
- Crabtree, A. D., & DeBusk, G. K. (2008). The effects of adopting the balanced scorecard on shareholder returns. *Advances in Accounting*, 24(1), 8–15. <https://doi.org/10.1016/j.adiac.2008.05.016>
- Cross, K. F., & Lynch, R. L. (1992). For good measure. *CMA Magazine*, (April), 20–23.
- Cuccurullo, C., Aria, M., & Sarto, F. (2016). Foundations and trends in performance management. A twenty-five years bibliometric analysis in business and public administration domains. *Scientometrics*, 108, 595–611. <https://doi.org/10.1007/s11192-016-1948-8>
- Cuguero-Escofet, N., & Rosanas, J. M. (2013). The just design and use of management control systems as requirements for goal congruence. *Management Accounting Research*, 24, 23–40. <https://doi.org/10.1016/j.mar.2012.11.001>
- Davis, S., & Albright, T. (2004). An investigation of the effect of Balanced Scorecard implementation on financial performance. *Management Accounting Research*, 5, 135–153. <https://doi.org/10.1016/j.mar.2003.11.001>
- de Waal, A. (2018). *Defining and measuring high performance organization*. Retrieved May 3, 2023, from <https://www.hpocenter.nl/wp-content/uploads/2018/07/Clute-2018-Defining-and-measuring-the-high-organizational-organization-De-Waal.pdf>
- de Waal, A. (2007). *Strategic performance management. A managerial and behavioural approach*. Palgrave Macmillan.
- Eccles, R. G. (1991). The performance measurement manifesto. *Harvard Business Review*, 69(1), 131–137.
- Ferreira, A., & Otley, D. (2009). The design and use of management control systems: An extended framework for analysis. *Management Accounting Research*, 20, 263–282. <https://doi.org/10.1016/j.mar.2009.07.003>
- Folan, P., & Browne, J. (2005). A review of performance measurement: Towards performance management. *Journal Computers in Industry*, 56(7), 663–680. <https://doi.org/10.1016/j.compind.2005.03.001>
- Franco-Santos, M., Lucianetti, L., & Bourne, M. (2012). Contemporary performance measurement systems: A review of their consequences and a framework for research. *Management Accounting Research*, 23, 79–119. <https://doi.org/10.1016/j.mar.2012.04.001>
- Franco-Santos, M., Kennerley, M., Pietro, M., Martinez, V., Mason, S., Marr, B., Gray, D., & Neely, A. (2007). Towards a definition of a business performance measurement system. *International Journal of Operations and Production Management*, 27(8), 784–801. <https://doi.org/10.1108/01443570710763778>
- Franco, M., & Bourne, M. (2003). Factors that play a role in “managing through measures”. *Management Decision*, 41(8), 698–710. <https://doi.org/10.1108/00251740310496215>
- Govindarajan, V., & Shank, J. K. (1992). Strategic cost management: Tailoring controls to strategies. *Journal of Cost Management*, 6(3), 14–25.
- Guenther, T. W., & Heinicke, A. (2019). Relationships among types of use, levels of sophistication, and organizational outcomes of performance measurement systems: The crucial role of design choices. *Management Accounting Research*, 42, 1–25. <https://doi.org/10.1016/j.mar.2018.07.002>
- Hall, M. (2008). The effect of comprehensive performance measurement systems on role clarity, psychological empowerment and managerial performance. *Accounting Organizations and Society*, 33(2–3), 141–163. <https://doi.org/10.1016/j.aos.2007.02.004>

- HassabElnaby, H. R., Said, A. A., & Wier, B. (2005). The retention of nonfinancial performance measures in compensation contracts. *Journal of Management Accounting Research*, 17, 23–42. <https://doi.org/10.2308/jmar.2005.17.1.23>
- Hope, T., & Hope, J. (1995). *Transforming the bottom line*. Nicholas Brealey Publishing.
- Hoque, Z. (2004). A contingency model of the association between strategy, environmental uncertainty and performance measurement: Impact on organizational performance. *International Business Review*, 13, 485–502. <https://doi.org/10.1016/j.ibusrev.2004.04.003>
- Hoque, Z., & James, W. (2000). Linking balanced scorecard measures to size and market factors: Impact on organizational performance. *Journal of Management Accounting Research*, 12, 1–17. <https://doi.org/10.2308/jmar.2000.12.1.1>
- Irfani, D. P., Wibisono, D., & Basri, M. H. (2020). Integrating performance measurement, system dynamics, and problem-solving methods. *International Journal of Productivity and Performance Management*, 69(5), 939–961. <https://doi.org/10.1108/IJPPM-12-2018-0456>
- Ittner, C. D., Larcker, D. F., & Randall, T. (2003). Performance implications of strategic performance measurement in financial service firms. *Accounting, Organizations and Society*, 28(7–8), 715–741. [https://doi.org/10.1016/S0361-3682\(03\)00033-3](https://doi.org/10.1016/S0361-3682(03)00033-3)
- Jazayeri, M., & Scapens, R. W. (2008). The business values scorecard within BAE systems: The evolution of a performance measurement system. *British Accounting Review*, 40(1), 48–70. <https://doi.org/10.1016/j.bar.2007.10.007>
- Jukka, T. (2023). Does business strategy and management control system fit determine performance? *International Journal of Productivity and Performance Management*, 72(3), 659–678. <https://doi.org/10.1108/IJPPM-11-2020-0584>
- Kadak, T., & Laitinen, E. K. (2016a). What matters with PMS? Critical check points in the success of PMS. *Studies in Managerial and Financial Accounting, Performance Measurement and Management Control: Contemporary Issues*, 31, 111–140. <https://doi.org/10.1108/S1479-351220160000031004>
- Kadak, T., & Laitinen, E. K. (2016b). Are more formal performance management systems more successful. In *Accounting, Auditing, and Taxation, ICAAT 2016* (pp. 173–189). Atlantis Press. <https://doi.org/10.2991/icaat-16.2016.19>
- Kadak, T. (2011). *Creation of a supportive model for designing and improving the performance management system of an organisation. Case studies*. Tallinn University of Technology, TUT Press.
- Kaplan, R. S., & Norton, D. P. (2006). *Alignment: Using the balanced scorecard to create corporate synergies*. Harvard Business School Press.
- Kaplan, R. S., & Norton, D. P. (2001). *The strategy-focused organization: How balanced scorecard companies thrive in the new business environment*. Harvard Business School Press.
- Kaplan, R. S., & Norton, D. P. (1996). *The balanced scorecard*. Harvard Business School Press.
- Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard – measures that drive performance. *Harvard Business Review*, (January/February), 71–79.
- Laitinen, E. K., & Kadak, T. (2019). Explaining success of performance management systems: The role of chain of key factors. *International Journal of Productivity and Performance Management*, 68(2), 362–388. <https://doi.org/10.1108/IJPPM-01-2018-0005>
- Lohman, C., Fortuin, L., & Wouters, M. (2004). Designing a performance measurement system: A case study. *European Journal of Operational Research*, 156, 267–286. [https://doi.org/10.1016/S0377-2217\(02\)00918-9](https://doi.org/10.1016/S0377-2217(02)00918-9)
- Meekings, A. (1995). Unlocking the potential of performance measurement: A guide to practical implementation. *Public Money and Management*, 8(4), 1–8. <https://doi.org/10.1080/09540969509387888>
- Malina, M. A., & Selto, F. H. (2001). Communicating and controlling strategy: an empirical study of the effectiveness of the balanced scorecard. *Journal of Management Accounting Research*, 13, 47–90. <https://doi.org/10.2308/jmar.2001.13.1.47>

- Matos, L. D. S., Ensslin, S. R., & Ensslin, L. (2019). A review on the performance measurement systems life cycle. *Lex Localis – Journal of Local Self-Government*, 17(4), 939–959.
- Miles, R. E., & Snow, C. C. (1978). *Organizational strategy, structure and process*. McGraw-Hill. <https://doi.org/10.2307/257544>
- Morgan, G. (2007). *Images of organization*. Sage Publications.
- Neely, A. D. (2008). *Does the balanced scorecard work: An empirical investigation*. (Research paper, 1/08). Cranfield University, School of Management, Cranfield.
- Neely, A. D. (2005). The evolution of performance measurement research: developments in the last decade and a research agenda for the next. *International Journal of Operations and Production Management*, 25(12), 1264–1277. <https://doi.org/10.1108/01443570510633648>
- Nudurupati, S. S., Garengo, P., & Bititci, U. S. (2021). Impact of the changing business environment on performance measurement and management practices. *International Journal of Production Economics*, 232, 1–15. <https://doi.org/10.1016/j.ijpe.2020.107942>
- Said, A. A., HassabElnaby, H. R., & Wier, B. (2003). An empirical investigation of the performance consequences of nonfinancial measures. *Journal of Management Accounting Research*, 15, 193–223. <https://doi.org/10.2308/jmar.2003.15.1.193>
- Sardi, A., Sorani, E., Ferrais, A., & Garengo, P. (2020). Evolutionary paths of performance measurement and management system: the longitudinal case study of a leading SM. *Measuring Business Excellence*, 24(4), 495–510. <https://doi.org/10.1108/MBE-01-2020-0016>
- Simons, R. (1995). *Levers of control: How managers use innovative control systems to drive strategic renewal*. Harvard Business School Press.
- Speckbacher, G., Bischof, J., & Pfeiffer, T. (2003). A descriptive analysis on the implementation of balanced scorecards in German-speaking countries. *Management Accounting Research*, 14, 361–387. <https://doi.org/10.1016/j.mar.2003.10.001>
- SPSS Inc. (2001). *The SPSS twostep cluster component: A scalable component enabling more efficient customer segmentation* (Technical report). Chicago, IL.
- Tangen, S. (2005). Insights from practice Analysing the requirements of performance measurement systems. *Measuring Business Excellence*, 9(4), 46–54. <https://doi.org/10.1108/13683040510634835>
- Taticchi, P., Balachandran, K., & Tonelli, F. (2012). Performance measurement and management systems: state of the art, guidelines for design and challenges. *Measuring Business Excellence*, 16(2), 1–19. <https://doi.org/10.1108/13683041211230311>
- Vancil, R. F. (1973). What kind of management control do you need? *Harvard Business Review*.
- Yu, L., Perera, S., & Crowe, S. (2008). Effectiveness of the balanced scorecard: The impact of strategy and causal links. *Journal of Applied Management Accounting Research*, 6(2), 37–56.