Explaining success of performance management systems: the role of chain of key factors

EXPLAINING SUCCESS OF PERFORMANCE MANAGEMENT SYSTEMS: THE ROLE OF CHAIN OF KEY FACTORS

ABSTRACT

This study makes use of the logical chain of management systems (PMS) and corporate performance. We use the strength of the chain to key factors (KFs) to explain success of performance capture PMS success KFs. First, we assume that perceived environmental uncertainty (PEU) is positively associated with the strength (*H1*). The higher PEU, the stronger is the chain as a response to uncertainty. Second, we assume that the strength improves performance (*H2*) but thirdly, that the impact of the strength is negatively moderated by competition (*H3*). Fourth, we assume that this improvement leads to superior corporate performance (*H4*). The research model is tested by the partial least squares (PLS) model in a sample of 61 Estonian and Finnish firms. Empirical evidence contradicts with *H1* but gives support to *H2, H3,* and *H4*. PEU is negatively related to the strength of chain.

Highlights

- Perceived environmental uncertainty (PEU) has a negative impact of the strength of the causal chain of PMS success key factors (KFs)
- The strength of the chain is positively associated with improvement in performance
- The impact of the strength of the chain on financial performance is negatively moderated by competition
- The improvement in performance is positively associated with the attainment level of strategic goals
- The improvement in performance does not significantly affect corporate profitability

Keywords

Performance Management Systems (PMS); success of PMS; chain of key factors (KFs); PEU; performance; profitability

1. INTRODUCTION

Performance Management System (PMS) can be defined as the process of quantifying and improving the efficiency and effectiveness (performance) of an organization. PMS plays a central role in the management of a modern organization. It does not only tell whether an organization is successful, but, if designed and used properly, can also help an organization implement its strategy and improve its performance (Kaplan and Norton 1996; Rompho and Boon-itt 2012). In this case, PMS can be considered successful, because the ultimate goal of any management system is to improve performance. However, if the design and implementation of the PMS are not carried out with care, PMS can lead to dysfunctional behavior and impair the performance of the entire organization. In that case, PMS can be regarded as failed. Therefore, the design and the implementation of PMS are important issues for management practice and research to diminish the risk to fail. This study concentrates on this topic.

There is a growing trend of literature concerned with the design and implementation of PMSs but few studies of their success and failure (Bourne 2005). There are certainly many success stories, but there is now a growing literature addressing also the difficulties of implementation (McCunn 1998; Bourne et al. 1999; Schneiderman 1999; Bourne, Mills, Wilcox, Neely, and Platts 2000) and it is claimed that up to 70% of performance measurement initiatives fail (McCunn 1998). In general, evidence on the effects of these initiatives on performance improvement is mixed (Malina and Selto 2001; Davis and Albright 2004; Bedford, Brown, Malmi, and Sivabalan 2008; Yu, Perera, and Crowe 2008; Neely 2008). In this study, we try to shed light to the reasons for mixed results. There are also attempts to develop systematic methods to assess PMS (Bititci, Carrie, and Mcdevitt 1997; Najmi, Rigas, and Fan 2005; Tangen 2004; Kadak and Laitinen 2016). These studies provide comprehensive methodology of how PMS should be assessed. In this study, we use one of these methodologies as a basis of our empirical analysis.

Methodologies are often based on logical order of actions to measure and improve performance. For example, Wettstein and Kueng (2002) assessed PMS success according to six dimensions following this order: scope of measurement, data collection, storage of data, communication of performance results, use of performance measures, and quality of performance measurement processes. However, Olsen et al. (2007) suggested three generic criteria to assess a PMS's effectiveness: causality, continuous improvement, and process control. Kadak and Laitinen (2016) developed a method to assess success of a PMS based on a logical chain of fourteen key factors (KF). These KFs include links to strategy and causal links within the PMS, which affect theoretically the effectiveness of a PMS (Kaplan and Norton 1996; 2001; Yu, Perera, and Crowe 2008). They also consider incentive systems and multiple levels of organization playing important role in PMSs (Bedford, Brown, Malmi, and Sivabalan 2008). Kadak and Laitinen (2016) showed that the strength of the chain is a robust indicator of PMS success and failure.

The purpose of this study is to expand the framework developed by Kadak and Laitinen (2016) in several ways. Kadak and Laitinen only considered the direct relationship between the strength of the logical chain and the success of PMS. In this study, we will firstly consider the effect of perceived environmental uncertainty (PEU) on the strength of the chain. In the research to date, there has been limited qualitative and quantitative empirical research examining the nature of the changes in Management Control Systems made in response to environmental changes or

uncertainty (Pock 2007). PEU is an important organizational factor, since management information systems are primarily understood as a response to PEU to construct a buffer against the uncertainty (Chenhall and Morris 1986; Mia and Chenhall 1994). We expect that the chain is stronger, the higher is PEU. Secondly, we will analyse the moderating effect of competition on the success of PMS. We expect that success as measured by improvement in performance is lower, when competition is high. Competition may force firms to continuously revise information systems as responses to threats and opportunities in the competitive environment (Mia and Clarke 1999). However, in competitive environment it is more challenging to increase performance. These kinds of effects of PEU and competition may explain why prior empirical evidence about the success of PMS is mixed. Thirdly, we will analyse the effect of improvement in performance on corporate success measures to test whether this improvement is strong enough to lead to superior performance. This analysis can also potentially give an explanation for mixed findings, since some success studies measure improvement effect while some studies measure corporate performance.

In summary, the objective of this study is to develop and to test a research model based on the KF chain framework introduced by Kadak and Laitinen (2016). For testing our research model in this framework, we will present four hypotheses on the relationship between the strength of the chain, PEU, competition, and corporate performance. These hypotheses will be tested using the partial least squares (PLS) method applied to a small sample of Estonian and Finnish firms. The findings will remarkably contribute to empirical research on PMS success.

This paper is organized in the following way. The introductory section explained the motivation and objectives of the study. In the second section, a summary of the chain framework will be briefly summarized and the research model developed. In this context, four hypotheses are derived. The third section presents the empirical data and methods of the study while the fourth section presents our empirical findings and discussed the results. The final section summarizes the study. It also outlines some topics for future research on the success of PMS.

2. THEORETICAL FRAMEWORK

2.1. Chain of KFs

Kadak and Laitinen (2016) presented a framework to assess the success of a PMS based on a set of fourteen KFs. The idea of this framework was to develop a logical chain of check points where each KF was represented by a check point measured on a scale from 0 to 1. Kadak and Laitinen argued that the strength of this chain is closely associated with the success or the failure of a PMS. It was hypothesized that the stronger the chain, the higher is the probability of success in PMS implementation. The strength of the chain was measured by the distribution of the values of check points. The higher the values are in general (sum, average, median), the higher is the likelihood to success. Empirical evidence strongly supported the proposed framework. In the following text, we only shortly review the fourteen check points.

1. Clearly expressed mission/vision statement

The mission of the organization should be clear and based on the preferences of stakeholders. In general, mission refers to the reason why organization exists (Simons 2000). Mission statement identifies the requirements to attract and maintain shareholders, employees, and customers and to

do so in ways that are socially acceptable (Chenhall 2003). There can be conflicts between different stakeholder groups, because of having different/contradictory preferences. But to enhance existence of the organization, these conflicts have to overcome to get a clear mission statement. This mission statement creates a vision referring to a picture of the organization in the future.

2. Clearly expressed strategy, aligned with the mission

The strategy of the organization should be clearly expressed and aligned with the mission and contextual factors. Strategy briefly describes how an organization intends to fulfil its mission based on its potential, operating environment and considering the stakeholders' interests (Kadak 2011). The need for an appropriate fit between a company's context, its business strategy and its MCS is an underlying assumption of much of the empirical contingency-style management control research (Chenhall and Langfield-Smith 1998; Perera, Harrison, and Poole 1997). Thus, strategy is also based on stakeholders' preferences and should be aligned with the mission. It is a way to achieve corporate mission.

3. PMS is based on identified causal relationships between CSFs

PMS should be consisted of a logical set of CSFs based on the causal relationships in the strategy map. This kind of strategy map ensures that PMS will be connected with strategy of organization due to use causal relations which are between different elements of strategy and which may be set into different areas of CSFs (Waal 2007). Causal links help to integrate various strategic areas with the organization and improve information flow across these strategic areas (Kaplan and Norton 1996).

4. Clearly stated corporate organization-level objectives (CO)

The organization should clearly express corporate-level objectives which are derived from the strategy and are congruent with the CSFs in the strategy map. These objectives make the strategy more specific and concrete for implementation (Kadak 2011). The objectives should describe concrete activities which lead to the expected final results (Waal 2007).

5. Organization-level performance measures that form a comprehensive set of performance measures

The organization should have a comprehensive set of PMs (that covers all CSFs), measuring the attainment levels of COs in relation to target values, and forming a mutually congruent set aligned with COs. Since each CSF is critical, each of them should be accompanied by PMs making PMS comprehensive (Laitinen 2004). A clear link between the strategy and performance measures enables PMS to be used effectively (Yu, Perera, and Crowe 2008). If targets are unreachable, it results in undesirable behavior (Beekes, Otley, and Ururuka 2010).

6. Delegation of organization-level COs as goals to every hierarchical level of the organization

Corporate objectives (COs) should be delegated as goals to every hierarchical level of the organization so that congruence of these goals between and within every hierarchical level is attained. The main purpose of PMS is to implement organizational strategy downward to the departmental level (Daft and Macintosh 1984). Therefore, in PMS it is essential that COs are

translated into operative goals and cascaded the latter down through the organization (Chenhall 2003).

7. Comprehensive set of PMs at each organizational level

The organization should have a comprehensive set of performance measures which measure the attainment level of goals with help of target values in every hierarchical level of organization. There must be congruence of PMs so that they are aligned with goals in every hierarchical level of organization. These kinds of PMs are thus used at different levels in organization to evaluate success in achieving goals and thus satisfying the expectations of different stakeholders (Ferreira and Otley 2009).

8. Identification of key processes (series of activities) critical to attain COs

The organization should identify key processes to attain corporate objectives and delegate these processes to attain goals in every hierarchical level of organization. In addition, the organization should have performance measures for each key process in every hierarchical level of organization for input, process, and output control. The key processes should be derived from measures of goal and be critical for the achievement of the goal associated with that CSF and measure (Kadak 2011).

9. PMS is designed and implemented interactively with the users of PMS

The designing and implementation of PMS should be carried out interactively with the users of PMS. For successful building and implementation of PMS it is necessary to have from the beginning the involvement and commitment of top-management and members of organization. Performance management and implementation of PMS is very important, and thus this must be top priority (Waal 2007).

10. PMS is used both interactively and diagnostically to create a dynamic tension

In order to be successful (to improve performance), PMS should be used both interactively and diagnostically to create dynamic tensions for the organization. The organization need to create an appropriate dynamic tension that is likely to stimulate the right mix between compliant behavior and creative search efforts necessary for organizational success (Simons 2000).

11. PMS is intensively used by employees in charge

PMS should be intensively used by the staff in charge in order to be successful in improving performance of the organization. This characteristic also considers PMS as an information system and refers partially to the concept of system use that is an important determinant of system success (DeLone and McLean 2003).

12. PMS is associated with an incentive system

The organization should have an incentive system connected with PMS that motivates employees to perform actions consistent with the goals allocated to them. If PMS is not connected with an appropriate incentive system, it is not motivational to drive employees towards improved performance. PMSs allow the design of goal-congruent incentive systems. Reward and compensation systems are designed to align individual interests with those of the organization (Simons 1995).

13. PMS produces valid and reliable information to users in time and in a useful form

The value of PMS is in its ability to provide the users of the systems with valid, reliable, timely, and usable information for their work. These kinds of characteristics consider PMS as an information system and focus on information quality. Information quality can include a large number of attributes such as relevance, understandability, accuracy, conciseness, completeness, understandability, currency, timeliness, and usability (DeLone and McLean 2003). Information quality is a critical determinant of PMS.

14. PMS is continuously updated

PMS should be continuously updated for changes in the organization and its surrounding environment. If PMS is based on an out-of-date model of organization and its organization, its value for staff in improving performance can be questioned. Environments change, organizations change, and so PMSs also need to change in order to sustain their relevance and usefulness (Ferreira and Otley 2009). Thus, PMS requires continuous improvements and revisions.

2.2. Hypotheses

The distribution of the fourteen check point values refers to the strength of the chain of KFs. This strength plays the central role of the present research model outlined by Figure 1. This model is based on four different research hypotheses surrounding the strength of the chain. Firstly, we hypothesize that PEU is positively associated with the strength of the chain (*H1*). Secondly, we propose that the strength has a positive relationship with the success of a PMS as reflected by improvement in performance (*H2*). This hypothesis is already verified by Kadak and Laitinen (2016) using a different statistical methodology. However, we assume thirdly that the level of competition negatively moderates the positive impact of strength of the chain on performance (*H3*). Finally, we expect that improvement in performance leads the firm to superior performance at the level of corporate (*H4*).

(Figure 1 here)

Hypothesis H1

The essence of PMS is that it provides broad information to the management for performance control based on past and future events, financial and non-financial measures, and internal and external information (Chenhall and Morris 1986; Brecht and Merle 1996; Tillema 2005). In uncertain situations, managers tend to place greater emphasis on a sophisticated information system, which provides managers with broad information (Mia 1993; Mia and Chenhall 1994). When PEU is high, managers require additional information to cope with the complexities of the environment. More broad information can help to reduce uncertainty and improve managerial decision-making (Gul and Chia 1994; Abernethy and Guthrie 1994). Therefore, management information systems are primarily understood as a response to PEU to construct a buffer against the uncertainty (Chenhall and Morris 1986; Mia and Chenhall 1994). Thus, we expect that when designing a PMS, managers make the logical chain of check points stronger, the higher is PEU.

The stronger the chain, the stronger is the buffer against uncertainty. We present the following hypothesis (*H1*):
Hypothesis *H1*: The higher PEU, the stronger is the chain of check points in PMS.

Hypothesis H2
The logical chain framework introduced by Kadak and Laitinen (2016) is based on previous research of CSFs in PMS design and implementation (Bourne 2005; Waal 2007; Kadak 2011). Although prior studies have provided less than definite findings as to the performance improvements that may result from implementation of a PMS, this research generally shows that PMS can improve performance (Davis and Albright 2004; Malmi 2001; Malina and Selto 2001; Bedford, Brown, Malmi, and Sivabalan 2008). However, the extent to which a firm gains this performance improvement is affected by the design, implementation, and use of the PMS. These characteristics are reflected in this study by the strength of the chain of check points. It is expected that PMS can increase both non-financial and financial performance (Malmi 2001; Malina and Selto 2001; Bryant, Jones and Widener 2004). This impact is expected to be more extensive, the stronger is the chain of check points for a PMS. Thus, we present the following hypotheses:
Hypothesis *H2a*: The stronger the chain of check points, the more extensive (positive) is the impact of PMS on non-financial performance.
Hypothesis *H2b*: The stronger the chain of check points, the more extensive (positive) is the impact of PMS on financial performance

Hypothesis H3
The effects of competition on the performance of a firm are twofold. Firstly, competition creates turbulence, stress, risk and uncertainty for the markets and it may force firms to continuously revise information systems, organizational design, advanced manufacturing technology and advanced management accounting practices as responses to threats and opportunities in the competitive environment (Mia and Clarke 1999; Baines and Langfield-Smith 2003). When competition is increasing, the firm is also motivated to achieve competitiveness through activities like new product launching, increasing value for customers and improved operating efficiencies (Hoque, Mia and Alam 2001). This means that under higher competition the firm is likely to put more effort to maintain its non-financial performance at least at the same level as competitors. Baines and Langfield-Smith (2003) state that improved practices lead to a greater reliance on nonfinancial accounting information which leads to improved organizational performance. Secondly, while motivating the firm to invest on maintaining its non-financial performance, competition may diminish its possibilities to increase or even maintain its financial performance, like profitability. Under intensive (price, product, or marketing channel) competition, it is challenging to gain financially from improved non-financial performance (Khandwalla 1972; Kaplan 1990; Fisher 1992). Therefore, we expect that competition has different effects on the impact of PMS on non-financial and financial performance. We present the following hypotheses:
Hypothesis *H3a*: Competition does not affect the impact of PMS on non-financial performance.
Hypothesis *H3b*: The higher competition, the less extensive (positive) is the effect of PMS on financial performance.

Hypothesis H4

Prior research of the impact of PMS on the performance has been based on the argument that PMS will positively affect the performance of the organization. However, research findings have been mixed providing less definite results on that issue. We believe that mixed findings are largely due to different settings and different performance measures adopted in studies. Bedford, Brown, Malmi, and Sivabalan (2008) summarize that empirical research on the issue has considered performance differences between PMS and non-PMS adopting firms (Ittner, Larcker, and Randall 2003; Davis and Albright 2004; Neely 2008), managerial perceptions of the general performance impact of PMS implementation and use (Malmi 2001; Malina and Selto 2001), and the association between non-financial performance measures and financial outcomes (Said, Hassan, and Wier 2003; Bryant, Jones, and Widener 2004). The multitude of performance concepts makes the comparison of evidence difficult and confusing.

In this study, we test the effect of (perceived) performance improvement on performance at three different levels: attainment of strategic goals, performance as compared with competitors, and profitability. We expect that improvement in both non-financial and financial performance has a significant impact on attainment of strategic goals that is the most central task of PMS (Kaplan and Norton 1992). However, we assume that only improvement in non-financial performance makes an important effect on relative performance compared with competitors. This assumption is justified because financial benefits are difficult to gain and to maintain more extensively than competitors do. Finally, we expect that neither non-financial nor financial performance improvements given by PMS are strong enough alone to lead the firm to reach superior performance in terms of profitability that is an outcome of multitude of characteristics. We present the following hypotheses:

Hypothesis *4a*: Improvement in non-financial performance has a positive impact on attainment of strategic goals.

Hypothesis *4b*: Improvement in financial performance has a positive impact on attainment of strategic goals.

Hypothesis *4c*: Improvement in non-financial performance has a positive impact on performance as compared with competitors.

Hypothesis *4d*: Improvement in financial performance has not an impact on performance as compared with competitors.

Hypothesis *4e*: Improvement in non-financial performance has not an impact on profitability of the firm.

Hypothesis *4f*: Improvement in financial performance has not an impact on profitability of the firm.

3. DATA AND STATISTICAL METHODS

3.1. Sample of firms

The empirical data for the study was gathered by internet questionnaires organized at the same time in spring 2015 both in Estonia and Finland among business sector firms. The identical questionnaire translated in Estonian and Finnish was used in both countries respectively. In Estonia, the sample of firms was randomly selected from the population of firms employing more than 50 employees. From different sources, email addresses of 500 Estonian firms were

randomly selected and an invitation to respond to the survey was sent to the top manager of the firm (CEOs or CFOs). Then, after a couple of follow-up emails, 56 managers had responded to the survey that makes a response rate over 10%. All the responded firms are included in the data of this study. The largest firm employs more than 2000 employees. The sample of Estonian firms represents wide variety of different industries.

The address (email) information of Finnish managers was got from Suomen Markkinointi Rekisteri Oy (Finland Marketing Register Ltd) including email addresses of managers from 691 firms from the target industries. In all, 189 email addresses did not technically operate because of changed addresses, changes in the organization, or absence of the respondent. Then, after follow-up emails, only 50 managers responded to the questionnaire (about 10% of target industries). From the 50 responded firms, only 5 firms from different industries employed more than 50 employees. Because of the size limit set for the Estonian sample, only these five firms were included in the data of this study. Thus, we have a sample of 61 (56 + 5) firms all together. Because of the small sample size, the results of this pilot study should be considered preliminary.

3.2. Questionnaire

Performance

Appendix 1 presents the questions used in the questionnaire. Panel 1 presents the questions used to measure performance and the impact of PMS on performance. Firstly, perceived performance was measured by the achievement rate of strategic objectives (STPER) and general performance level as compared with competitors (COMPER) using a 7-step Likert scale. Secondly, performance was assessed by profitability based on the ratio of EBIT to total assets (ROI). Thirdly, the impact of PMS on non-financial (NFIPER) and financial performance (FINPER) during the last three years was separately measured as self-rated by the manager on a 7-step scale.

Check points

The fourteen KFs (check points) described in the theoretical framework are measured by the questions presented in Panel 2 of Appendix 1. In all, the question pattern includes fifteen questions associated with the fourteen KFs. KF 10 is reflected by two different questions referring to the diagnostic and interactive uses of PMS separately. The questions are formulated easy to respond. Ten of the questions are based on an on/off scale (0 or 1) while five questions are measured on a Likert scale from 1 (do not agree at all) to 7 (agree perfectly). The values of the five questions based on the 7-step Likert scale were standardized by deducting unity from the value (V) and dividing the difference by 6 or (V-1)/6. In this way, the value was constrained into the range from 0 to 1.

Strength of chain

The strength of the logical chain of KFs (check points) (KFCHAIN) was measured by three different measures reflecting the characteristics of the distribution of check point values. Firstly, it is measured by the mean of the fourteen score values (MEAN) reflecting the average value. Secondly, it is measured by the median score (MEDIAN) at the midpoint of distribution of observed scores, since for a skewed distribution the mean may not reflect the strength of the chain properly because of extreme scores. Thirdly, the strength is assessed by the skewness of the score distribution (SKEW), since it is assumed that for a stronger chain the mass of the distribution is concentrated more on the right side (towards higher scores) than for a weaker

chain. Cronbach Alpha for the standardized values of these three measures is 0.971 indicating a very high reliability.

PEU and competition

Panel 3 shows the question to assess perceived environmental uncertainty (PEU). This measure is based on seven dimensions of PEU applied originally by Gordon and Narayanan (1984) and Govindarajan (1984). Cronbach Alpha of this construct is 0.683 which cannot be increased by dropping any of the seven dimensions. Panel 4 presents the question measuring the intensity of competition on a 7-step Likert scale (COMPET). Competition is defined in this context as an external factor that affects the growth and profitability of the firm and is assessed only by one general question without any further dimensions (such as competition on price, product, and marketing channel).

Control variables

The strength of chain is potentially affected by many other variables besides PEU. Therefore, we use also a set of control variables to explain this strength. Panel 5 presents the questions for the control variables. The three first control variables measure the size of organization that affects PMS in many ways (Chenhall 2003). Larger firms have more power in controlling operational environment. Their organizational structure tends to be more elaborate and formalized than those of smaller firms (Mintzberg 1989). In statistical analyses, size is measured by two different variables. Firstly, it is measured by the logarithm of the number of employees referring to the size of organization (LNNOFEMPL). This measure correlates very weakly with total assets (ASSETS) and net sales (NETSALES). Therefore, secondly, these two size measures are used to build a construct for business size (BUSIZE). Cronbach Alpha for this construct is 0.942 indicating a very high reliability.

The fourth variable refers to industry (INDUSTRY). Firms acting in different industries have differences in the degree of replication, routine, and task variety in their production systems which can affect the characteristics of PMS (Khandwalla 1972; Abernethy and Lillis 1995). In this analysis, we apply two different dummy variables referring to manufacturing (INDUSTRY1) and service (INDUSTRY2) firms.

The fifth and sixth control variables refer respectively to the generic (PORSTRAT) and market (MILESTRAT) strategies of the firm. In general, strategy is the way in which management can affect the nature of the external environment, the structural arrangements, and management practice (Chenhall and Langfield-Smith 1998; Chenhall 2003). The generic strategy reflects the typology of the cost-leadership strategy, the differentiation strategy, and the focus strategy (Porter 1980; Langfield-Smith 1997). It is measured by self-typing using a brief description for each strategy. In the present analysis, we use a dummy variable to refer to the cost-leadership strategy (PORSTRAT1).The market strategy is here reflected by the typology presented by Miles and Snow (1978) including three main strategies: prospector strategy, analyzer strategy and defender strategy (P-A-D typology). Similarly, we measure this variable by self-typing on the basis of a short description of each strategy. Market strategy is measured in this analysis by a binary dummy variable for the prospector strategy (MILESTRAT1).

The design of organizational structure is closely related to the management systems such as PMS (Miles and Snow 1978; Chenhall 2003). The organizational structure is measured in this study by two variables which are self-assessed by the manager on a 7-step Likert scale. Firstly, the horizontal organizational structure (DELEGAT) is measured by the degree of decision-making decentralization using the construct applied by Govindarajan (1988). This construct is based on four dimensions. The fourth dimension (DELEGAT4) notably impaired the reliability of the construct and was eliminated. Cronbach Alpha for the construct was after elimination 0.669 indicating lower than good reliability. Secondly, the vertical structure is reflected by the number of organizational (decision-making or management) levels (HIERLEVELS).

3.3. PLS

The research model outlined in Figure 1 accompanied with a set of control variables is tested by the partial least squares (PLS) method (Stage, Carter, and Nora 2004). This method has been used quite frequently in management accounting and social science research (Baines and Langfield-Smith 2003; Luft and Shields 2003; Smith and Langfield-Smith 2004). PLS is useful in this study when the sample size is limited and the theory is not strong. In addition, PLS is able to accommodate non-normal data due to less rigorous assumptions underpinning the technique (Smith and Langfield-Smith 2004). It can handle many independent variables, even when there are more predictors than cases and even when predictors display multicollinearity (Temme, Kreis, and Hildebrandt 2006).

Reflective indicator blocks

The PLS model is estimated by the SMARTPLS 2.0 (M3) software (http://www.smartpls.com/). When assessing the quality of the model, the reliability and validity of the measurement model should be first assessed. The resulting structural model should then be interpreted. The present PLS model will include latent variables with reflective indicators. The standard model quality assessment methods are developed for latent variables with these kinds of indicators (Henseler, Ringle, and Sinkovics 2009). For the latent variables (KFCHAIN, BUSIZE, and DELEGAT) reliability is measured by Cronbach Alpha based on the indicator intercorrelations. In order for the latent variable scale to have a good reliability, the reliability coefficient should have a value equal or higher than 0.7.

Cronbach Alpha is a test for the internal consistency of a model. Since Alpha tends to provide a severe underestimation in PLS models, the composite reliability is also used. It should not be lower than 0.6. The reliability of indicators varies and therefore the reliability of each indicator should be assessed. It is proposed that the absolute standardized outer loadings for indicators should exceed 0.7. However, it is also recommended to eliminate indicators with a loading less than 0.4 although one should be careful when eliminating indicators (Henseler, Ringle, and Sinkovics 2009).

For the assessment of reflective model validity, the convergent and discriminant validity should be examined. Convergent validity measures that a set of indicators represents one and the same underlying construct indicated by their unidimensionality. It can be measured by the average variance extracted (AVE) which should exceed 0.5 indicating that a latent variable is able to explain more than 50% of the variance of its indicators. The discriminant validity can firstly be assessed by the Fornell-Larcker (1981) criterion that the AVE of the latent variable should be

greater than the squared correlation of the latent variable with any other latent variables. Secondly, it can be measured by the criterion that the loading of each indicator on the latent variable exceeds all of its cross-loadings on other latent variables.

Structural model

The structural (outer) PLS model can be assessed by several criteria. The essential criterion is the coefficient of determination (R squared, R^2) of the endogenous latent variables. Chin (1998) describes R^2 values of 0.67, 0.33, and 0.19 as substantial, moderate, and weak, respectively. Low results cast doubts that the model is incapable to explain the latent variable. The significance of the individual path coefficients can used to assess the empirical validity of the theoretically assumed relationships using the t-test based on bootstrapping. Thus, the t-values of the parameters are calculated by bootstrapping (1000 sub-samples with 61 cases).

In addition, (average) communality can be used to assess how much (on average) the latent variable can reproduce of the variance of its indicators. It is measured as the average of all squared correlations between each indicator and the latent variable. Finally, redundancy can be used to measure the percent of the variance of the indicators for a latent variable that can be explained by the independent latent variables directly connected to the latent variable. High redundancy means refers to a high ability to explain.

4. EMPIRICAL RESULTS

4.1. Descriptive statistics

Appendix 2 presents descriptive statistics for the fourteen KF (check point) variables, PEU, and control variables. Panel 1 shows statistics for the check point variables. The lowest mean is got by CSF indicating that only 36.1% of the sample firms have described causal relationships between CSFs. USESTY has also a low mean showing that only 43.6% of the firms use PMS both interactively and diagnostically. However, up to 86.9% of the firms have a PMS including a set of organization-level performance measures (ORGKPI) while 85.2% of them have a stated mission (MIS).

Panel 2 presents statistics for PEU. It shows that on average the highest uncertainty is associated with regulation development (PEU7) and financial market development (PEU5). Only for these items the average value exceeds the middle point of the scale (4.4 and 4.3). Technology development (PEU4) and labor union behavior (PEU6) can be predicted with the highest accuracy referring to low PEU.

Panel 3 presents descriptive statistics for the control variables. The skewness and kurtosis are quite low for the variables except for those reflecting the size of the firm. The sample firms have on average 342 employees (NOFEMPL). However, the median size is only 148 employees indicating a skewed size distribution. Manufacturing (INDUSTRY1) and service (INDUSTRY2) firms represent respectively 34.0% and 28.0% of the firms. More than half of the firms use differentiation generic strategy (56.0%) (PORTSTAT2) and analyzer market strategy (66.0%) (MILESTRAT3). The level of decentralization in decision making (DELEGAT) and the number of hierarchical levels (HIERLEVELS) are on average relatively low.

Table 1 presents descriptive statistics for the model variables (control variables excluded). PEUSUM refers to the average of the seven PEU items, not to the PLS construct. The averages of the perceived performance measures (STRPER and COMPER) clearly exceed the middle point of the scale referring to better than average performance. In the same way, the variables reflecting improvement in performance (NFIPER and FINPER) as an outcome of PMS are above the middle point. The return on investment ratio (ROI) is on average 9.8% but the variation range is large. The median of the check point values (MEDIAN) notably exceeds the average (MEAN) referring to a skewed distribution of values. On average, PEU (PEUSUM) is quite low whereas the level of competition (COMPETIT) is on average relatively high.

(Table 1 here)

Table 2 shows the Pearson correlation coefficients for the model variables. In general, the correlations are relatively high. The performance measures except for ROI are strongly correlated and so are the items of the strength of chain. Profitability (ROI) is only correlated with the improvement in non-financial performance (NFIPER). The level of competition (COMPETIT) is negatively correlated with the performance as compared with competitors (COMPER) which is logical: the higher the level of competition, the more difficult is to reach the competitive level of performance. PEU (PEUSUM) is strongly and negatively correlated with the measures of the strength of chain (MEAN and MEDIAN) contradicting in a univariate analysis with our hypothesis *H1*.

(Table 2 here)

4.2. PLS Results

Table 3 presents statistical characteristics of the estimated PLS model. The characteristics in general refer to a good performance except that for the construct of PEU with an AVE value of 0.3530 (PEU). PEU and the control variables together explain 37.1% of the total variation in the strength of chain construct (KFSUM) referring to a moderate explanation power. The improvements in non-financial (NFIPER) and financial (FINPER) performance explain 39.3% of the variation in the attainment level of strategic goals (STRPER) but only 5.2% of that in the profitability ratio (ROI). The strength of chain (KFSUM) explains more of the variation in the improvement in financial performance (FINPER) than of that in non-financial performance (NFIPER). The coefficients of determination for these variables are respectively 22.5% and 13.5% indicating lower than moderate explanation power.

(Table 3 here)

Table 4 shows the outer weights of the latent variables in the PLS model. The loadings for the constructs of the strength of chain (KFCHAIN) and business size (BUSIZE) are very high. For the construct of decentralization (DELEGAT) outer loadings are lower and the loading of the first item (DELEGAT1) is below 0.7. However, the outer loadings of the construct of PEU are low and almost all of them are below that value reflecting a low average variance extracted (AVE). The problem with PEU is that all items are relatively weakly correlated with each other so that elimination of any items does not improve its quality. However, several experiments

showed that the elimination of items or using the sum variable (PEUSUM) in the PLS analysis instead of the latent variable does not change the interpretation of the findings.

(Table 4 here)

The path coefficients of the PLS model are presented in Table 5 classified according to the research hypotheses. PEU has a very strong impact on the strength of chain (KFCHAIN) but this impact is negative contradicting with hypothesis *H1*. None of the eight control variables has a significant effect on the strength. The strength of the chain has a significant positive relationship with the improvement in non-financial (NFIPER) and financial performance (FINPER) supporting hypothesis *H2*. The level of competition (COMPETIT) as a moderating variable is not directly related with either of the improvement variables (NFIPER and FINPER) but it moderates negatively the effect of KFCHAIN on FINPER. It does not however significantly moderate the effect of KFCHAIN on NFIPER. Thus, findings give empirical support to hypotheses *H3a* and *H3b*.

The improvements in non-financial (NFIPER) and financial performance (FINPER) have both a significant positive impact on the attainment level of strategic goals (STRPER) supporting hypotheses *H4a* and *H4b*. However, only NFIPER has a significant positive impact on the performance as compared with competitors (COMPER) supporting both hypotheses *H4c* and *H4d*. Empirical evidence also supports hypotheses *H4e* and *H4f* since neither of the improvement variables has a significant effect on profitability (ROI). Figure 2 summarizes the significant paths in the estimated PLS model.

(Table 5 here)
(Figure 2 here)

Table 6 presents the total effects of PEU and the strength of chain (KFCHAIN) on the model outcome variables. The strength of chain has a significant positive total effect on all outcome variables. The effects are statistically very significant except that on profitability (ROI) which is significant only at *p*-level of 0.10 (2-tail). In the same way, PEU has a statistically significant negative total effect on the outcome variables with the exception for ROI. Thus, PEU has important effects on these variables although its effect in the model is only indirect and goes through the strength of chain (KFCHAIN).

(Table 6 here)

4.3. Discussion

It has been argued that up to 70% of PMSs fail in improving performance of organization (McCunn 1998). Therefore, a number of studies have searched for KFs for successful implementation of PMS (McCunn 1998; Bourne et al. 1999; Schneiderman 1999; Bourne, Mills, Wilcox, Neely, and Platts 2000; Kadak 2011). In this study, we used Kadak and Laitinen's (2016) concept of the chain of KFs as our framework. We tested a research model based on the relationships between PEU, strength of chain of KFs (check points), competition, and performance at different levels.

We expected firstly that PEU has a strong positive effect on the strength of chain but empirical evidence contradicted with our expectation (*H1*). Evidence showed that the relationship between PEU and the strength of chain is strong but negative. It indicates that managers perceiving higher environmental uncertainty pay less attention to build a strong chain than managers perceiving lower uncertainty.
This finding is anyway surprising since usually PMS is seen as a buffer against uncertainty and managers tend to use more sophisticated systems when PEU increases (Mia 1993; Mia and Chenhall 1994). Almost all firms in the sample are from Estonia. Therefore, we expect that our result at least partly depends on the special circumstances in Estonia. Estonia's characteristics are flexibility, openness, and pervasive principles of Estonia's economic policy (http://Estonia.eu).

Estonia is an e-country with a favorable business climate and cost advantages that is also open to growth. Successive governments have adhered to the principles of Estonia's economic success: a balanced state budget, liberal trade and investment laws, and the goal of joining the euro zone (Estonia.eu). Therefore, business environment for Estonian firms is characterized by stability and low risk. In our study, the average PEU was exceptionally low. On a 7-step Likert scale, 65% of the firms rated PEU as below 4 (middle point) and 92% as below 5.

The special attitude of the respondents toward PEU can be seen also in the construct of PEU. The items of the construct correlated only weakly leading to low Cronbach Alpha and AVE. Furthermore, deletion of any item did not improve the quality of the construct or alter the main findings: all items are negatively correlated with the strength of chain. We think that the result is also due to the fact that the relationship between the strength of chain and PEU is not linear but quadratic.

Figure 3 presents predictions of the three items of the chain as a regression function of PEU and PEU^2. This figure shows that there is a maximum for each item when PEU is between 3 and 4, and after the point PEU = 4 the value declines rapidly. This result implies that managers tend to build stronger chain when PEU is increasing but that weaker chain is preferred when PEU is above a certain limit. It may be that a strong chain leads to a structure that is too mechanistic for a firm under high PEU. These kinds of firms prefer organic structures (Burns and Stalker 1961).

(Figure 3 here)

The findings show that the strength of chain is positively associated with the success of PMS as measured by improvement in both non-financial and financial performance. This empirical result is consistent with our expectations (*H2*) and confirms the findings obtained by Kadak and Laitinen (2016). Because the chain is strongly based on KFs in PMS design, implementation, and use (Bourne 2005; Waal 2007; Kadak 2011), this result is not surprising. Thus, following Kadak and Laitinen (2016) our findings show that the strength of the chain of KFs can be used in assessing success and failure of PMSs. The stronger the chain, the higher is the likelihood of success. In practice, the concept of KF chain provides management with a check list that can be used to indicate potential for success and risk to fail.

We also hypothesized that high competition can diminish the positive effect of the strength of chain on financial performance (*H3b*) but not that on non-financial performance (*H3a*). High

competition motivates the firm to continuously improve its efficiency (Hoque, Mia, and Alam 2001). Competition does not hinder the firm increasing its non-financial performance but it is not easy to translate this increase into financial gain under high pressure of competition. This kind of interpretation is supported by our findings. Furthermore, correlations show that in general the effect of the strength of KF chain on financial performance is stronger than on non-financial performance. However, competition tends to diminish the differences in these effects.

Prior evidence on the effects of PMS on performance is mixed partly due to different settings and different measures employed (Bedford, Brown, Malmi, and Sivabalan 2008). We tested the effects for three different levels of performance measures. Firstly, we found that the increase in both non-financial and financial performance helps the firm to attain its strategic goals which conforms our expectations (*H4a* and *H4b*). PMS is thus a powerful tool to increase the attainment level of strategic goals as proposed in the context of BSC by Kaplan and Norton (1992).

Secondly, consistently with our expectations (*H4c* and *H4d*) we found that only increase in non-financial performance has a significant effect on performance as compared with competitors. The effect of increase in financial performance is weak probably due to the impact of competition.

Thirdly, we proposed that increase in performance is not strong enough to lead to superior performance in terms of the profitability of the firm (*H4e* and *H4f*). Empirical findings gave strong support for this proposition. Thus, different levels of performance levels give different messages about performance effects of PMS explaining why evidence on the issue is mixed.

5. SUMMARY

This study contributes to the research of the success and the failure of PMS. We tested a research model based on the relationships between PEU, strength of chain of KFs, competition, and performance measured at different levels. The data of our study consisted of a small sample of mainly Estonian firms which should be taken into account when assessing the findings. We hope that in the future studies based on larger sample will strengthen our results. In this stage, the findings should be considered preliminary.

Empirical findings showed that the chain of KFs for a PMS is stronger, the lower is PEU. However, we found that this relationship is more quadratic than linear. For a low uncertainty the effect of PEU on the strength of chain is positive but after a turning point this effect is reversed. We believe that this kind of finding is partly associated with the peculiar characteristics of Estonian firms, since the PEU reported by the managers is exceptionally low. It is also possible that strong chain of KFs implies a mechanistic organization that is not competitive under high PEU.

We also found that the effect of the strength of chain on the increase in financial performance is lower, the higher is competition. This means that it is difficult to translate potential increase in non-financial performance to financial gain when competition is high. The effect of PMS is not

strong enough to lead to superior performance in terms of profitability although it contributes to the attainment of strategic objectives and performance as compared with competitors.

These findings contribute to our understanding about environmental determinants of PMS success and its effects on performance measures at different levels of organization. We believe that the mixed nature of empirical findings on the success of PMSs (Yu, Perera, and Crowe 2008; Bedford, Brown, Malmi, and Sivabalan 2008; Neely 2008) can be explained by the effects of PEU and competition, and the use of success measures reflecting different levels of performance.

We think that our finding about the relationship between strong PMS and low PEU needs more research to provide overview how PMSs differ between the organizations acting under condition of low and high PEU. This kind of research is related with the statement of Chenhall and Morris (1986) and Mia and Chenhall (1994) about the PEU as an important organizational factor. Further research about differences of PMS in different levels of PEU would give more insight about this important issue.

We also think that the relationship of the strength of PMS and low PEU may indicate that there is potentially some meaning about broad information other than usually discussed (Gul and Chia 1994; Abernethy and Guthrie 1994). We suggest also further research on the differences in PMSs between organizations acting in high and low competition. At the level of the chain, we did not find any connection between the strength of chain and competition, although competition may force firms to continuously revise information systems (Mia and Clarke 1999). However, one can ask if an organization in high competition focuses more on operational aspects of performance and an organization in low competition more on the strategic aspects.

The findings also provide a view that financial and non-financial performance act as antecedent of strategic performance. This finding is consistent with idea of Fitzgerald, Johnston, Brignall, Silvestro, and Voss (1991) who divided measures into two basic types – those that relate to results and those that focus on determinants of these results. It is also consistent with the idea of the categories of leading and lagging measures in the context of BSC (Kaplan and Norton 1992).

We think that the results about impacts of PEU and competition on the PMS and on performance at different levels provide practical contribution of this research. Namely, the levels of PEU and competition should be taken into the account when designing the PMS of organization.

REFERENCES

Abernethy, M.A., and A.M. Lillis. 1995. The impact of manufacturing flexibility on management control system design. *Accounting, Organizations and Society* 20 (4): 241–259.

Abernethy, M.A., and C.H. Guthrie. 1994. An empirical assessment of the “Fit” between strategy and management information system design. *Accounting and Finance* 34 (2): 49-66.

Baines, A., and K. Langfield-Smith. 2003. Antecedents to management accounting change: a structural equation approach. *Accounting, Organizations and Society* 28 (7/8): 675–698.

Bedford, D., D.A. Brown, T. Malmi, and P. Sivabalan. 2008. Balanced Scorecard Design and Performance Impacts: Some Australian Evidence. *Journal of Applied Management Accounting Research* (Summer): 17-36.

Beekes, W., D. Otley, and V. Ururuka. 2010. The use and consequences of performance management and control systems: a study of a professional services firm. *Research executive summary series* 6 (10). CIMA.

Bititci, U.S., A.S. Carrie, and L. Mcdevitt. 1997. Integrated performance measurement systems: a development guide. *International Journal of Operations & Production Management* 17 (5/6): 522–534.

Bourne, M. 2005. Researching performance measurement system implementation: the dynamics of success and failure. *Production Planning & Control* 16 (2): 101–113.

Bourne, M.C.S., J.F. Mills, M. Wilcox, A.D. Neely, and K.W. Platts. 2000. Designing, implementing and updating performance measurement systems. *International Journal of Production and Operations Management* 20 (7): 754–771.

Bourne, M.C.S., J.F. Mills, J. Bicheno, D.J. Hamblin, M. Wilcox, A.D. Neely, and K.W. Platts. 1999. Performance measurement system design: testing a process approach in manufacturing companies. *International Journal of Business Performance Measurement* 1 (2).

Brecht, H.D., and P.M. Merle. 1996. Accounting information systems: the challenge of extending their scope to business and information strategy. *Accounting Horizons* 10 (4): 16–22.

Bryant, L., D. Jones, and S.K. Widener. 2004. Managing Value Creation within the Firm: An Examination of Multiple Performance Measures *Journal of Management Accounting Research* 16: 107-131.

Burns, T., and G.M. Stalker. 1961. *The Management of Innovation*. Tavistock, London.

Chenhall, R.H. 2003. Management control system design within its organizational context: findings from contingency-based research and directions for the future *Accounting, Organizations and Society* 28 (2–3): 127–168.

Chenhall, R., and K. Langfield-Smith. 1998. The relationship between strategic priorities, management techniques and management accounting: an empirical investigation using a systems approach. *Accounting, Organizations and Society* 23 (3): 243-264.

Chenhall, R., and D. Morris. 1986. Organic decision and communication processes and management accounting systems in entrepreneurial and conservative business organizations. *Omega International Journal of Management Science* 23 (5): 485–497.

Chin, W.W. 1998. The partial least squares approach for structural equation modeling. In G.A. Marcoulides. *Modern Methods for Business Research*: 295-336. Mahwah, NJ: Lawrence Erlbaum Associates, Publisher.

Chong, V., and K. Chong. 1997. Strategic choices, environmental uncertainty and SBU performance: A note on the intervening role of management accounting systems. *Accounting and Business Research* 27 (4): 268-76.

Daft, R. L., and N. Macintosh. 1984. The Nature and Use of Formal Control and Strategy Implementation. *Journal of Management*, 10 (Spring/Summer): 43–66.

Davis, S., and T. Albright. 2004. An investigation of the effect of Balanced Scorecard implementation on financial performance. *Management Accounting Research* 5:135-153.

DeLone, W.H., and E.R. McLean. 2003. The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems* 19 (4): 9–30.

Ferreira, A., and D. Otley. 2009. The Design and Use of Management Control Systems: An Extended Framework for Analysis. *Management Accounting Research* 20: 263–282.

Fisher J. 1992. Use of nonfinancial performance measures. *Journal of Cost Management* 6: 31–38.

Fitzgerald, L., R. Johnston, T.J. Brignall, R. Silvestro, and C. Voss. 1991. *Performance Measurement in Service Businesses*. London: CIMA Publishing.

Fornell, C., and D.F. Larcker. 1981. Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research* 18 (1): 39-50.

Gordon, L.A., and V.K. Narayanan. 1984. Management accounting systems, perceived environmental uncertainty and organization structure: An empirical investigation. *Accounting, Organizations and Society* 9 (1): 33-47.

Govindarajan, V. 1988. A contingency approach to strategy implementation at the business-unit level: Integrating administrative mechanisms with strategy. *Academy of Management Journal* 31: 828-853.

Govindarajan, V. 1984. Appropriateness of accounting data in performance evaluation: an empirical investigation of environmental uncertainty as an intervening variable. *Accounting, Organizations and Society* 9: 125-135.

Gul, F., and Y.M. Chia. 1994. The Effects of Management Accounting Systems, Perceived Environmental Uncertainty and Decentralization on Managerial Performance: A Test of Three-way Interaction. *Accounting, Organizations and Society* 19: 413-426.

Henseler, J., C.M. Ringle, and R.R. Sinkovics. 2009. The use of partial least squares path modeling in international marketing. *Advances in International Marketing* 20: 277-319.

Hoque Z., L. Mia, and M. Alam. 2001. Market competition, computer-aided manufacturing and use of multiple performance measures: an empirical study. *The British Accounting Review* 33: 23–45.

Hoque, Z., and W. James. 2000. Linking balanced scorecard measures to size and market factors: Impact on organizational performance. *Journal of Management Accounting Research* 12 (1): 1-17.

Ittner, C.D., D.F. Larcker, and T. Randall. 2003. Performance implications of strategic performance measurement in financial service firms *Accounting, Organizations and Society,* 28: 715-741.

Ittner, C.D., D.F. Larcker, and M.W. Meyer. 2003. Subjectivity and the Weighting of Performance Measures: Evidence from a Balanced Scorecard. *The Accounting Review* 78 (2): 725-758.

Ittner, C.D., and D.F. Larcker. 1998. Innovations in performance measurement: trends & research implications. *Journal of Management Accounting Research* 10: 205–238.

Kadak, T., and E.K. Laitinen. 2016. 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.

Kadak, T. 2011. *Creation of a Supportive Model for Designing and Improving the Performance Management System of an Organisation. Case studies.* Doctoral dissertation. Tallinn University of Technology.

Kaplan, R.S., and D.P. Norton. 1996. *The Balanced Scorecard,* Harvard, Harvard Business School Press.

Kaplan, R.S., and D.P. Norton. 1992. The balanced scorecard – measures that drive performance, *Harvard Business Review* 70 (1/2): 71–79.

Kaplan, R.S. 1990. Limitations of cost accounting in advanced manufacturing environments. In *Measures for Manufacturing Excellence*, edited by R.S. Kaplan, 15–38. Boston: Harvard Business School Press.

Khandwalla, P. 1972. The effects of different types of competition on the use of management controls. *Journal of Accounting Research*, 10 (3): 275–295.

Laitinen, E.K. 2004. *Performance Measurement & Management: Strategic View*. University of Vaasa, Levon-institute. Strategic Management Accounting Research Unit. Publication 114.

Langfield-Smith, K. 1997. Management control systems and strategy: A critical review. *Accounting, Organizations and Society* 22 (2): 207-232.

Luft, J., and M.D. Shields. 2003. Mapping management accounting: Graphics and guidelines for theory-consistent empirical research. *Accounting, Organizations and Society* 28 (2-3): 169-249.

Malina, M.A., and F.H. Selto. 2001. Communicating and controlling strategy: an empirical study of the effectiveness of the balanced scorecard. *Journal of Management Accounting Research* 13: 47-90.

Malmi, T. 2001. Balanced Scorecard in Finnish Compamies: A research Note. *Management Accounting Research*, 12: 207-220.

McCunn, P. 1998. The balanced scorecard: the eleventh commandment. *Management Accounting*: *Magazine for Chartered Management Account, December*, 76 (11): 34–36.

Mia, L., and B. Clarke. 1999. Market competition, management accounting systems & business unit performance. *Management Accounting Research* 10 (2): 137–158.

Mia, L., and R. Chenhall. 1994. The usefulness of management accounting systems, functional differentiation and managerial effectiveness. *Accounting, Organizations and Society* 19(1): 1-13.

Mia, L. 1993. The role of MAS information in organization: An empirical study. *British Accounting Review* 25: 269-85.

Miles, R.E., and C.C. Snow. 1978. *Organizational Strategy, Structure and Process*. New York: McGraw-Hill.

Mintzberg, H. 1989. *Mintzberg on Management: Inside our Strange World of Organizations*. New York: The Free Press, MacMillan, Inc.

Najmi, M., J. Rigas, and I.S. Fan. 2005. A framework to review performance measurement systems. *Business Process Management Journal* 11 (2): 109–22.

Neely, A. 2008. Does the balanced scorecard work: An empirical investigation. Cranfield University. School of Management. Research paper 1/08. Cranfield.

Norreklit, H. 2000.The balance on the balanced scorecard – a critical analysis of some of its assumptions. *Management Accounting Research* 11 (1): 65-88.

Olsen, E.O., H. Zhou, D. Lee, Y. Ng, C.C. Chong, and P. Padunchwit. 2007. Performance measurement system and relationships with performance results: a case analysis of a continuous improvement approach to PMS design. *International Journal of Productivity and Performance Management* 56 (7): 559–82.

Perera, S., G. Harrison, and M. Poole. 1997. Customer focused manufacturing strategy and the use of operations based non-financial performance measures: a research note. *Accounting, Organizations and Society,* 22 (6): 557-572. In *Contingency-based Design of Management Control Systems*, edited by T. Pock. 2007. Doctroral dissertation. University of St. Gallen.

Pock, T. 2007. *Contingency-based Design of Management Control Systems*. Doctroral dissertation. University of St. Gallen.

Porter, M.E. 1980. *Competitive Strategy: Techniques for Analyzing Industries and Competition*. New York: Free Press.

Rompho, N., and S. Boon-itt. 2012. Measuring the success of a performance measurement system in Thai firms. *International Journal of Productivity and Performance Management* 61 (5): 548–562.

Said, A.A., R.H. Hassan, and B. Wier. 2003. An Empirical Investigation of the Performance Consequences of Nonfinancial Measures. *Journal of Management Accounting Research* 15:193-223.

Simons, R.L. 2000. *Performance measurement and control systems for implementing strategy*. Upper Saddle River: Pearson.

Simons, R. L. 1995. *Levers of control: how managers use innovative control systems to drive strategic renewal.* Boston: Harvard Business School Press Books.

Smith, D., and K. Langfield-Smith. 2004. Structural equation modeling in management accounting research: critical analysis and opportunities. *Journal of Accounting Literature* 23: 49–86.

Stage, F.K., H. Carter, and A. Nora. 2004. Path Analysis: an introduction and analysis of a decade of research. *Journal of Educational Research* 98 (1): 5-12.

Tangen, S. 2004. *Evaluation and Revision of Performance Measurement Systems.* Doctoral dissertation. Woxe'n Centrum, Department of Production Engineering Royal Institute of Technology Stockholm.

Tillema, S. 2005. Towards an integrated contingency framework for MAS sophistication: case studies on the scope of accounting instruments in Dutch power and gas companies. *Management Accounting Research* 16 (1): 101 – 129.

Temme, D., H. Kreis, and L. Hildebrandt. 2006. PLS Path Modeling – A Software Review. *SFB 649 Discussion Papers SFB649DP2006-084.* Sonderforschungsbereich 649, Humboldt University, Berlin, Germany.

Waal, A. A. 2007. *Strategic Performance Management*. A Managerial and Behavioural Approach, Palgrave Macmillan.

Wettstein, T., and P. Kueng. 2002. *A maturity model for performance measurement systems.* In *Management Information Systems* edited by C.A. Brebbia, and P. Pascolo. GIS and Remote Sensing, WIT Press, Southampton.

Yu, L., S. Perera, and S. Crowe. 2008. Effectiveness of the Balanced Scorecard: The Impact of Strategy and Causal Links. *Journal of Applied Management Accounting Research* 6 (2).

APPENDICES

Appendix 1. Questions Presented in Questionnaire.

Panel 1. Performance

1. STPER: How the achievement rate of the latest strategic objectives was assessed on a scale from 1 (extremely poor) to 7 (extremely good)?

2. COMPER: What is the performance level of your firm as compared with your competitors on a scale from 1 (extremely poor) to 7 (extremely good)?

3. ROI: What was EBIT of your firm in MEUR at the end of last accounting year? How much were total assets of your firm at the end of last accounting year in millions of euro?

ROI = 100 · EBIT / Total assets

4. NFIPER: How much you consider the performance management system has improved the non-financial performance (productivity, efficiency, effectiveness) in the three last years on a scale from 1 (extremely little) to 7 (extremely much)?

5. FINPER: How much you consider the performance management system has improved the financial performance (profitability, margins, turnover ratios) in the three last years on a scale from 1 (extremely little) to 7 (extremely much)?

Panel 2. Key Factors of PMS

1. MIS: Our organization has a stated mission (it is documented in a written form) (yes or no).

2. STR: Our organization has a document describing corporate strategy (it is documented in a written form) (yes or no).

3. CSF: Our organization's strategy document (map) includes descriptions of causal relationships between Critical Success Factors (CSFs) (yes or no).

4. STROBJ: Our corporate strategy document includes a description of corporate organization-level objectives (yes or no)

5. ORGKPI: Our corporate performance management system includes a set of organization-level performance measures (yes or no).

6. UNOBJ: Our organization has goals set on different hierarchical levels of the organization (yes or no).

7. UNKPI: Our organization has a set of performance measures on different levels of organization (yes or no).

8. KPR: Our organization has defined key processes (yes or no).

9. IMPUSE: Our Performance Management System of Organization was built and designed with the users of this system (assess on a scale from 1 = does not agree at all to 7 = agree perfectly).

10.1. ACTUSE: Our Performance Management System of Organization is used interactively where managers are constantly and personally discussing with subordinates to learn strategic uncertainties and involved subordinates decisions (assess on a scale from 1 = does not agree at all to 7 = agree perfectly).

10.2. DNGUSE: Our Performance Management System of Organization is used diagnostically where managers monitor organizational outcomes and correct deviations from preset standards of performance (assess on a scale from 1 = does not agree at all to 7 = agree perfectly).

USESTY = ACTUSE · DNGUSE (for standardized variables 0-1)

11. RESP: Our Performance Management System of Organization is intensively used by employees in charge (users of the system) (assess on a scale from 1 = does not agree at all to 7 = agree perfectly).

12. INSYS: Our Performance Management System of Organization is associated with an incentive system to motivate employees towards achievement of objectives (yes or no).

13. QUALINF: Our Performance Management System of Organization produces valid, reliable, timely and usable information for managerial work (assess on a scale from 1 = does not agree at all to 7 = agree perfectly).

14. ADJ: Our Performance Management System of Organization is systematically updated when changes in organization or environment are emerged (yes or no).

Panel 3. Perceived Environmental Uncertainty (PEU)

1. PEU: How well you are able to predict the following phenomena in the longer (2-3 years) view (assess on a scale: 1 = with extremely high accuracy … 7 = with extremely low accuracy):

1. Supplier behavior (raw material) (PEU1)
2. Competitor behavior (PEU2)
3. Customer behavior (demand) (PEU3)
4. Technology development (PEU4)
5. Financial market development (PEU5)
6. Labor union behavior (PEU6)
7. Regulation development (PEU7)

Panel 4. Level of Competition in the Market

1. COMPET: How would you describe the degree of competition in the market? (Competition is here an external factor that affects the growth and profitability of the firm) (assess on a scale: 1 = Extremely low level of competition …. 7 = Extremely high level of competition)

Panel 5. Control Variables

1. NOFEMPL: What is the number of full time equivalent employees at your firm at the end of last accounting year?

LNNOFEMPL = LN(NOFEMPL)

2. ASSETS: How much were total assets of your firm at the end of last accounting year in millions of euro?

3. NETSALES: How much were net sales of your firm at the end of last accounting year in millions of euro?

4. INDUSTRY: What is the main industry of your firm? Pick one.

1. Manufacturing (INDUSTRY1)
2. Service (INDUSTRY2)
3. Trade (INDUSTRY3)
4. Construction (INDUSTRY4)
5. Public sector (INDUSTRY5)
6. Other (INDUSTRY6)

5. PORSTRAT: What is the main generic strategy of your firm? Pick one.

1. Cost leadership (to produce products at lowest costs) (PORSTRAT1)
2. Differentiation (to produce unique or clearly differentiated products) (PORSTRAT2)
3. Focus (to concentrate on a niche with respect to narrow range of customers, narrow range of products, or limited geographical area) (PORSTRAT3)

6. MILESTRAT: What is the main market strategy of your firm (circle one)?

1. Prospector: involves active programs to expand into new markets and stimulate new opportunities and products (MILESTRAT1)
2. Defender: entails finding, and maintaining a secure and relatively stable market and invests on existing products (MILESTRAT2)
3. Analyzer: shares the characteristics of the prospector and the analyzer (MILESTRAT3)

7. DELEGAT: How much the following decisions are delegated from the top management to the lower level managers? (assess on a scale 1 = Extremely little …. 7 = Extremely much)

1. Increasing (beyond budget) the level of expenditure for advertising and promotion (DELEGAT1)
2. Changing the selling price on a major product or product line (DELEGAT2)
3. Increasing (beyond budget) the level of expenditure for research and development (DELEGAT3)
4. Increasing (beyond budget) the number of employees in a business unit (DELEGAT4)

8. HIERLEVELS: What is the number of hierarchical levels in decision making / management at your firm? (assess on a scale ? (1 = Extremely few …. 7 = Extremely many)

Appendix 2. Descriptive Statistics of Variables

Panel 1. KFs of PMS Success

	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
MIS	0,000	1,000	0,852	0,358	-2,038	2,226
STR	0,000	1,000	0,803	0,401	-1,565	0,462
CSF	0,000	1,000	0,361	0,484	0,595	-1,703
STROBJ	0,000	1,000	0,738	0,444	-1,108	-0,799
ORGKPI	0,000	1,000	0,869	0,340	-2,241	3,123
UNOBJ	0,000	1,000	0,803	0,401	-1,565	0,462
UNKPI	0,000	1,000	0,836	0,373	-1,862	1,514
KPR	0,000	1,000	0,803	0,401	-1,565	0,462
IMPL	0,000	1,000	0,587	0,268	-0,667	-0,026
USESTY	0,000	1,000	0,436	0,234	0,421	0,268
RESP	0,000	1,000	0,604	0,260	-0,508	0,163
INSYS	0,000	1,000	0,840	0,373	-1,862	1,514
QUALINF	0,000	1,000	0,648	0,230	-0,772	0,586
ADJ	0,000	1,000	0,754	0,434	-1,210	-0,555

Legend:
MIS = Mission of organization
STR = Strategy of organization
CSF = Critical Success factors
STROBJ = Strategic objectives
ORGKPI = Organization level key performance indicators (KPIs)
UNOBJ = Unit level objectives
UNKPI = Unit level KPIs
KPR = Key processes
IMPL = Implementation of PMS
USESTY = Interactive and diagnostic use of PMS
RESP = Use of PMS by responsible managers
INSYS = Connection with incentive system
QUALINF = Quality of information
ADJ = Adjustment of PMS
For questions, see Appendix 1

Panel 2. Perceived Environmental Uncertainty (PEU)

Item	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
PEU1	2,000	7,000	3,787	1,427	0,603	-0,447
PEU2	2,000	7,000	3,967	1,316	0,380	-0,787
PEU3	2,000	6,000	3,656	1,094	0,495	-0,132
PEU4	1,000	5,000	3,197	1,108	0,204	-0,831
PEU5	2,000	7,000	4,295	1,145	0,009	-0,527
PEU6	1,000	6,000	3,557	1,103	0,350	0,089
PEU7	1,000	7,000	4,377	1,529	-0,149	-0,641

Legend:
Perceived uncertainty in:
PEU1 = Supplier behavior (raw material)
PEU2 = Competitor behavior
PEU3 = Customer behavior (demand)
PEU4 = Technology development
PEU5 = Financial market development
PEU6 = Labor union behavior
PEU7 = Regulation development

Panel 3. Control Variables

	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
NOFEMPL	52,000	2200,000	342,200	555,575	2,651	5,774
LNNOFEMPL	3,950	7,700	5,162	1,007	1,222	0,962
ASSETS	0,500	1532,000	76,705	223,106	5,249	31,368
NETSALES	1,700	4510,000	117,433	577,131	7,595	58,657
INDUSTRY1	0,000	1,000	0,340	0,479	0,672	-1,602
INDUSTRY2	0,000	1,000	0,280	0,452	1,012	-1,009
PORSTRAT1	0,000	1,000	0,180	0,388	1,705	0,937
PORSTRAT2	0,000	1,000	0,560	0,501	-0,237	-2,011
PORSTRAT3	0,000	1,000	0,260	0,444	1,108	-0,799
MILESTRAT1	0,000	1,000	0,180	0,388	1,705	0,937
MILESTRAT2	0,000	1,000	0,160	0,373	1,862	1,514
MILESTRAT3	0,000	1,000	0,660	0,479	-0,672	-1,602
DELEGAT1	1,000	7,000	2,869	1,756	0,799	-0,460
DELEGAT2	1,000	7,000	3,721	1,762	0,158	-0,901
DELEGAT3	1,000	6,000	2,623	1,540	0,779	-0,362
DELEGAT4	1,000	7,000	2,885	1,439	0,728	0,528
DELEGATSUM	1,000	6,330	3,071	1,318	0,398	-0,407
HIERLEVELS	1,000	5,000	2,890	1,002	0,237	0,185

Legend:
NOFEMPL = Number of employees
LNNOFEMPL = Logarithm of number of employees
ASSETS = Total assets
NETSALES = Net sales
INDUSTRY1 = Manufacturing industry (0 or 1)
INDUSTRY2 = Service industry (0 or 1)
PORSTRAT1 = Cost leadership strategy (0 or 1)
PORSTRAT2 = Differentiation strategy (0 or 1)
PORSTRAT3 = Focus strategy (0 or 1)
MILESTRAT1 = Prospector strategy (0 or 1)
MILESTRAT2 = Defender strategy (0 or 1)
MILESTRAT3 = Analyzer strategy (0 or 1)
DELEGAT1 = Decentralization of advertising and sales promotion decisions (1-7)
DELEGAT2 = Decentralization of pricing decisions (1-7)
DELEGAT3 = Decentralization of R & D expenditure decisions (1-7)
DELEGAT4 = Decentralization of employment hiring decisions (1-7)
DELEGATSUM = Average of DELEGAT1-3 (1-7)
HIERLEVELS = Number of hierarchical levels in decision making / management (1-7)

TABLES

Table 1. Descriptive Statistics of the Model Variables

Variable	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
STRPER	2,000	6,000	4,740	1,124	-0,258	-1,054
COMPER	2,000	7,000	4,820	1,232	-0,197	-0,565
ROI	-9,090	43,750	9,814	10,266	1,770	3,511
NFIPER	1,000	7,000	4,410	1,257	-0,362	-0,201
FINPER	1,000	7,000	4,180	1,204	-0,123	0,075
MEAN	0,024	0,960	0,709	0,213	-1,585	2,171
MEDIAN	0,000	1,000	0,838	0,312	-1,930	2,373
SKEW	-3,742	3,742	-1,113	1,402	1,451	3,441
PEUSUM	2,140	6,140	3,834	0,738	0,563	0,925
COMPETIT	1,000	7,000	5,300	1,395	-1,543	2,626

Legend:
STRPER = Level of strategic goals attainment (1-7)
COMPER = Performance compared with competitors (1-7)
ROI = Return on investment ratio (%)
NFIPER = Effect of PMS on non-financial performance
FINPER = Effect of PMS on financial performance
MEAN = Mean score of fourteen KFs
MEDIAN = Median score of fourteen KFs
SKEW = Skewness of score distribution of fourteen KFs
PEUSUM = Average of PEU items (1-7)
COMPETIT = Level of competition (1-7)
For questions, see Appendix 1

Table 2. Pearson Correlation Coefficients between the model Variables.

	STRPER	COMPER	ROI	NFIPER	FINPER	MEAN	MEDIAN	SKEW	PEUSUM	COMPETIT
STRPER	1,000									
COMPER	0,483***	1,000								
ROI100	0,350***	0,241*	1,000							
NFIPER	0,573***	0,458***	0,224*	1,000						
FINPER	0,590***	0,404***	0,195	0,721***	1,000					
MEANZ	0,286**	0,189	-0,004	0,372***	0,427***	1,000				
MEDIANZ	0,221*	0,156	-0,088	0,300**	0,361***	0,935***	1,000			
SKEWZ	-0,284**	-0,161	0,013	-0,375***	-0,412***	-0,949***	-0,868***	1,000		
PEUSUM	-0,304**	-0,216*	-0,105	-0,131	-0,172	-0,441***	-0,448***	0,418***	1,000	
COMPETIT	0,018	-0,337***	0,018	-0,023	-0,062	0,072	0,052	-0,078	0,007	1,000

Legend: * = p-value $<$ 0.1; **= p-value $<$ 0.05; *** = p-value $<$ 0.01
STRPER = Level of strategic goals attainment (1-7)
COMPER = Performance compared with competitors (1-7)
ROI = Return on investment ratio (%)
NFIPER = Effect of PMS on non-financial performance
FINPER = Effect of PMS on financial performance
MEAN = Mean score of fourteen KFs
MEDIAN = Median score of fourteen KFs
SKEW = Skewness of score distribution of fourteen KFs
PEUSUM = Average of PEU items (1-7)
COMPETIT = Level of competition (1-7)

Table 3. Statistical Characteristics of the Estimated PLS model and Latent Variables

Variable	AVE	Composite Reliability	R Square	Cronbach Alpha	Communality	Redundancy
STRPER	1,0000	1,0000	0,3931	1,0000	1,0000	0,2983
COMPER	1,0000	1,0000	0,2210	1,0000	1,0000	0,1011
ROI	1,0000	1,0000	0,0524	1,0000	1,0000	0,0220
NFIPER	1,0000	1,0000	0,1351	1,0000	1,0000	-0,0001
FINPER	1,0000	1,0000	0,2245	1,0000	1,0000	0,0036
KFSUM	0,8940	0,9619	0,3705	0,9406	0,8940	0,0083
PEU	0,3530	0,7895		0,6960	0,3530	
BUSIZE	0,9448	0,9716		0,9423	0,9448	
DELEGAT	0,5747	0,7996		0,6838	0,5747	

Legend:
STRPER = Level of strategic goals attainment (1-7)
COMPER = Performance compared with competitors (1-7)
ROI = Return on investment ratio (%)
NFIPER = Effect of PMS on non-financial performance
FINPER = Effect of PMS on financial performance
KFSUM = Construct of KFs (based on mean, median, and skewness of KFs)
PEU = Construct of PEU (based on PEU1-PEU7)
BUSIZE = Construct of business size (based on net sales and total assets)
DELEGAT = Construct of decentralization (based on DELEGAT1-3)

Table 4. Outer Weights of the Latent Variables

Variable	Weight	Standard Deviation	t statistic	*p*-value§
MEAN ← KFCHAIN	0,9803	0,0061	159,9532	0,0000
MEDIAN ← KFCHAIN	0,8911	0,0495	17,9903	0,0000
SKEW ← KFCHAIN	0,9629	0,0097	99,5264	0,0000
PEU1 ← PEU	0,5202	0,2385	2,1808	0,0331
PEU2 ← PEU	0,5101	0,2416	2,1109	0,0389
PEU3 ← PEU	0,5081	0,2052	2,4758	0,0161
PEU4 ← PEU	0,6306	0,1303	4,8409	0,0000
PEU5 ← PEU	0,6935	0,1452	4,7770	0,0000
PEU6 ← PEU	0,7022	0,1669	4,2083	0,0001
PEU7 ← PEU	0,5573	0,1460	3,8177	0,0003
ASSETS ← BUSIZE	0,9785	0,1408	6,9503	0,0000
NETSALES ← BUSIZE	0,9655	0,0799	12,0761	0,0000
DELEGAT1 ← DELEGAT	0,6385	0,2654	2,4056	0,0192
DELEGAT2 ← DELEGAT	0,8728	0,2294	3,8053	0,0003
DELEGAT3 ← DELEGAT	0,7448	0,2093	3,5589	0,0007

Legend:
§ = 2-tailed probability
KFCHAIN = Construct for the strength of the chain of KFs
MEAN = Mean score of fourteen KFs
MEDIAN = Median score of fourteen KFs
SKEW (-) = Skewness of score distribution of fourteen KFs (- = negation)
PEU = Construct of PEU
PEU1 = Supplier behavior (raw material)
PEU2 = Competitor behavior
PEU3 = Customer behavior (demand)
PEU4 = Technology development
PEU5 = Financial market development
PEU6 = Labor union behavior
PEU7 = Regulation development
BUSIZE = Construct of business size
ASSETS = Total assets
NETSALES = Net sales
DELEGAT = Construct of decentralization
DELEGAT1 = Decentralization of advertising and sales promotion decisions
DELEGAT2 = Decentralization of pricing decisions
DELEGAT3 = Decentralization of R & D expenditure decisions

Table 5. Path Coefficients of the Model

Path	Coefficient	Standard Deviation	t statistic	*p*-value§
1. Hypothesis *H1*				
PEU → KFCHAIN	-0,3923	0,1335	2,9378	0,0047
2. Hypothesis *H2*				
KFCHAIN → NFIPER	0,3649	0,1305	2,7962	0,0069
KFCHAIN → FINPER	0,4320	0,1130	3,8218	0,0003
3. Hypothesis *H3*				
KFCHAIN * COMPETIT → NFIPER	-0,0844	0,1711	0,4930	0,6237
KFCHAIN * COMPETIT → FINPER	-0,2283	0,1274	1,7923	0,0780
COMPETIT → NFIPER	-0,0471	0,1231	0,3829	0,7031
COMPETIT → FINPER	-0,0783	0,1169	0,6700	0,5054
4. Hypothesis *H4*				
NFIPER → STRPER (H4a)	0,3078	0,1484	2,0737	0,0423
FINPER → STRPER (H4b)	0,3676	0,1443	2,5480	0,0134
NFIPER → COMPER (H4c)	0,3462	0,1630	2,1236	0,0378
FINPER → COMPER (H4d)	0,1546	0,1665	0,9289	0,3566
NFIPER → ROI (H4e)	0,1744	0,2193	0,7952	0,4296
FINPER → ROI (H4f)	0,0686	0,2305	0,2978	0,7668
5. Control variables				
LNNOFEMPL → KFCHAIN	0,0546	0,1238	0,4415	0,6604
BUSIZE → KFCHAIN	0,1019	0,1177	0,8658	0,3900
INDUSTRY1 → KFCHAIN	-0,1279	0,1173	1,0908	0,2796
INDUSTRY2 → KFCHAIN	-0,1063	0,1350	0,7873	0,4342
PORSTRAT1 → KFCHAIN	0,1138	0,1171	0,9722	0,3348
MILESTRAT1 → KFCHAIN	0,0842	0,1227	0,6863	0,4951
DELEGAT → KFCHAIN	0,2014	0,1386	1,4537	0,1511
HIERARC → KFCHAIN	0,1682	0,1366	1,2314	0,2229

Legend:
§ = 2-tailed probability
PEU = Construct of PEU
KFCHAIN = Construct for the strength of the chain of KFs
NFIPER = Effect of PMS on non-financial performance
FINPER = Effect of PMS on financial performance
COMPETIT = Level of competition
STRPER = Level of strategic goals attainment
COMPER = Performance compared with competitors
ROI = Return on investment ratio (%)

LNNOFEMPL = Logarithm of number of employees
BUSIZE = Construct of business size
INDUSTRY1 = Manufacturing industry
INDUSTRY2 = Service industry
PORSTRAT1 = Cost leadership strategy
MILESTRAT1 = Prospector strategy
DELEGAT = Construct of decentralization

Table 6. Total Effects of PEU and the Strength of KF Chain

Path	Coefficient	Standard Deviation	t Statistic	*p*-value§
PEU → KFCHAIN	-0,3923	0,1407	2,7883	0,0071
PEU → NFIPER	-0,1432	0,0715	2,0024	0,0497
PEU → FINPER	-0,1695	0,0684	2,4790	0,0160
PEU → STRPER	-0,1064	0,0468	2,2721	0,0266
PEU → COMPER	-0,0758	0,0385	1,9691	0,0535
PEU → ROI	-0,0366	0,0267	1,3734	0,1747
KFCHAIN → NFIPER	0,3649	0,1305	2,7962	0,0069
KFCHAIN → FINPER	0,4320	0,1130	3,8218	0,0003
KFCHAIN → STRPER	0,2711	0,0767	3,5327	0,0008
KFCHAIN → COMPER	0,1931	0,0691	2,7964	0,0069
KFCHAIN → ROI	0,0933	0,0547	1,7061	0,0931

Legend:

§ = 2-tailed probability

PEU = Construct of PEU

KFCHAIN = Construct for the strength of the chain of KFs

NFIPER = Effect of PMS on non-financial performance

FINPER = Effect of PMS on financial performance

STRPER = Level of strategic goals attainment

COMPER = Performance compared with competitors

ROI = Return on investment ratio (%)

FIGURES

Figure 1. The Research Model

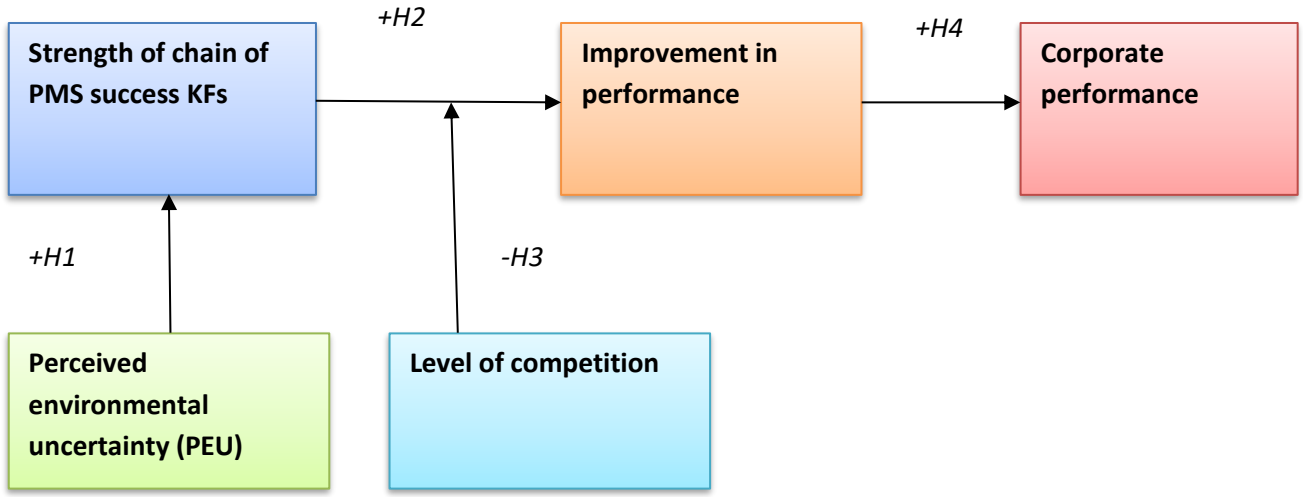
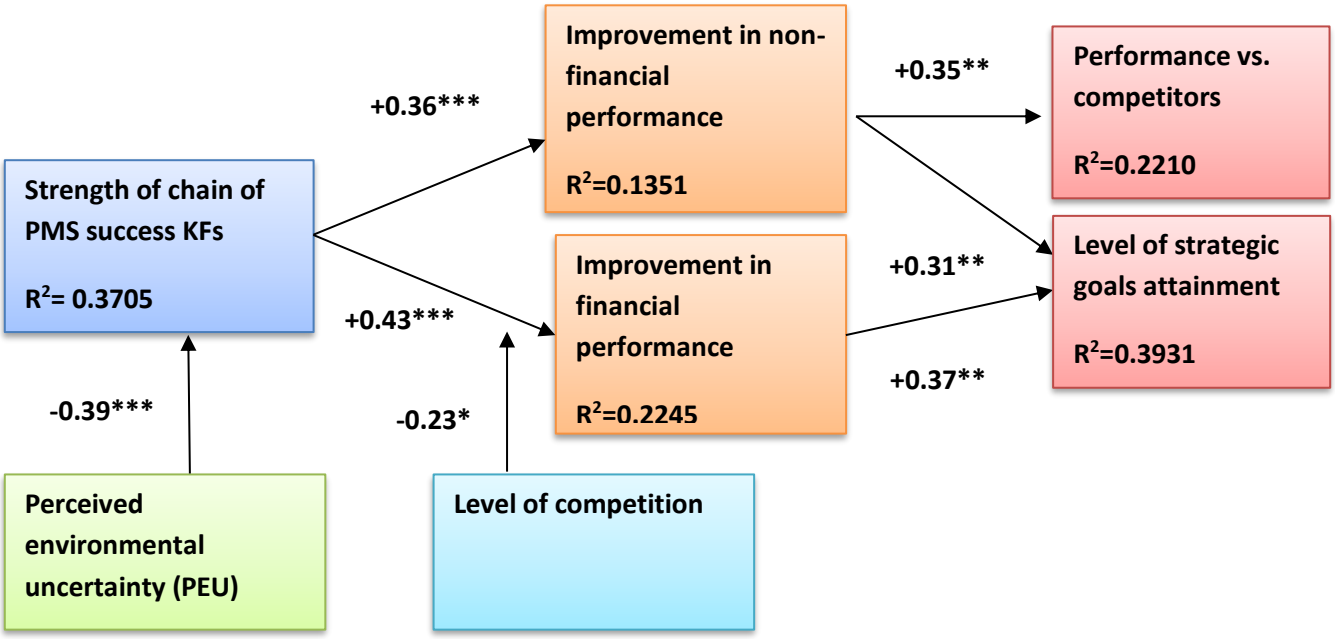
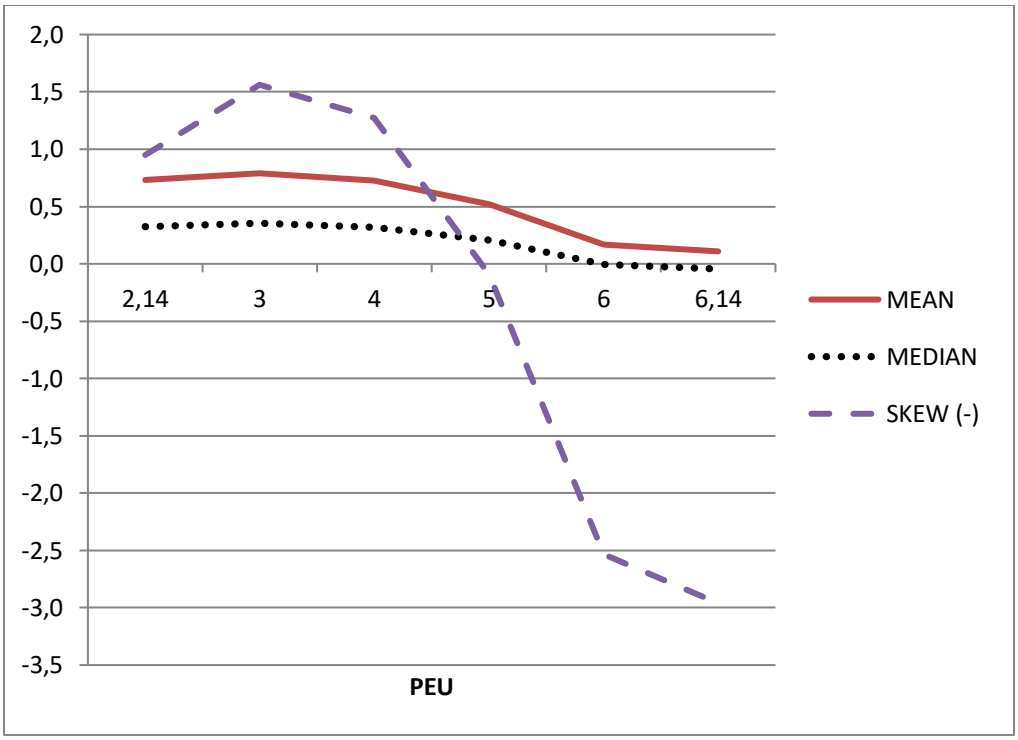


Figure 2. Estimated PLS Model (only statistically significant paths are showed)



Legend: * = *p*-value < 0.10; ** = *p*-value < 0.05; *** = *p*-value < 0.01 (2-tail)

Figure 3. Items of the Chain of KFs as Predicted as a Function of PEU and PEU^2



Legend:
MEAN = Mean score of fourteen KFs
MEDIAN = Median score of fourteen KFS
SKEW (-) = Skewness of scores of fourteen KFs (- = negation)
PEU = PEUSUM = Average of PEU items (1-7)