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The Effect of Performance Evaluation System Dimensions on Organizational Results: A Financial Approach and Organizational Capabilities

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Abstract

The comprehensive Performance Measurement System (PMS) clearly emphasizes the managers' role by explaining strategic purposes and various dimensions of performance. The present study aims to analyze empirical evidence about the effect of managers' emphasis on a particular type of function and complexity levels of PMS on its benefits and organizational performance based on Levers of Control (LOC) and Contingency Theory (CT). The study was conducted in 46 companies active in Persian Gulf Petrochemical Holding in 2022. Results from data modeling using partial least squares structural equations indicate that a higher emphasis on the interactive function of PMS increases its benefits in the studied sample, with no influence from the complexity level of PMS. In other words, the effect of diagnostic and interactive functions of PMS on its benefits have no significant difference in simple and complex systems. Results from the model's sensitivity analysis show the stability of findings based on different assumptions.

Keywords:
Diagnostic and Interactive Functions, Performance Measurement System, Complexity Level of Performance Measurement System

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1. Introduction

In the management literature, performance management systems (PMSs) are classically viewed as tools whose primary objective is to understand and monitor performance and ensure alignment and stability within the organization (Bititci et al., 2018; Henry and Wouters, 2020; Lucianetti et al., 2018); performance measurement system (PMS) is 'a system for tracking performance metrics'. It is essential to implementing a corporation; it helps translate strategy into actions and desired results, track progress, provide feedback, and encourage workers through rewards and penalties. Moreover, the measuring system must be based on the organizational strategy, assist in putting the plan into action, and provide feedback on whether the organization is 'on track' or whether adjustments in the course are required; organizations also require a balanced selection of measurements (Khourshed and Beshr, 2024). From another perspective, PMSs are a mechanism senior management adopts to link strategy and operations and promote behaviors and actions in line with the organization's goals (Bedford et al., 2023a; Mura et al., 2021). Essentially, PMSs fall under the 'levers of control' (LOC). According to Simons (1995), PMSs and other management control systems can be implemented as belief, boundary, diagnostic, or interactive systems (Pešalj et al., 2018; Daowadueng et al.,2023). Although the roles of all four levers are critical, researchers have generally focused on diagnostic and interactive use (Heinicke et al., 2016; Henri, 2006a; Koufteros et al., 2014; Mura et al., 2021). The former refers to monitoring results against prespecified goals and modifying deviations, and the latter refers to assessing performance by facilitating dialogue and promoting learning in line with the development of new strategic goals (Heggen and Sridharan, 2021; Sarstedt et al., 2020). The establishment of a PMS aims to improve accountability. The output components of the PMS consist of performance feedback, which improves internal performance and ensures transparency in external performance(Mahmoudi Yekebaghi et al., 2025).

In recent years, there has been increasing focus on PMS use and its effects (Bedford et al., 2023a; Bisbe and Malagueno, 2012; Bedford et al., 2023b; Bititci et al., 2018; Dubey et al.,2017; Heinicke et al., 2016; Simons, 2014). Review papers have generally highlighted the positive effects of PMSs (Hoque, 2014); however, there is ambiguous and sometimes contradictory empirical evidence regarding the effects of PMSs. As a noticeable study in this field, Endrikat et al. (2020) detected 25 experimental articles using a meta-analysis approach to examine the effect of PMSs on organizational performance (OP). They reached unique findings in terms of their high heterogeneity due to differences in design (sophistication level) and type of PMS use. Moreover, OP appraisal based on organizational capabilities reported a larger effect size than performance appraisal based on financial measures, indicating the significance of the appraisal method for organizational output in PMSs. Accordingly, combining all three variables determines the extent to which PMS benefits are realized (Endrikat et al., 2020).

Regarding the empirical evidence, it can be inferred that more detailed studies are required to examine the effects of the fit between sophistication level and PMS use on PMS benefits and OP. From another viewpoint, because the development and implementation of PMSs is time-consuming and costly, many companies implement such systems to align the company more efficiently with its strategy and control important performance metrics. In line with CT, the potential variables affecting the design and use of PMSs and their impact on OP should be explored (Franco-Santos et al., 2012).

This study addresses this research gap by concurrently examining the relationships between the design, functionality, and OP of PMSs.

In pursuit of the objectives of this research:

I. Experimental studies on the design and functionality of PMSs have recommended different conceptual frameworks; however, this study specifically focuses on the LOC framework proposed by Simons (1994, 1995, 2014), considering explicit controls (interactive and diagnostic) as integral management controls (MCs), in addition to boundary and belief systems.

II. Methodologically, empirical studies on PMS are primarily grounded in agency theory (Franco-Santos et al., 2012; Heinicke et al., 2016; Hoque, 2014; Lucianetti et al., 2018; Mura et al., 2021). Accordingly, this study also adopts this approach to explore the relationship between structural variables (design and functionality of PMSs) and OP.

III. The research sample encompassed Gulf Holding, which provides a diverse range of small and large enterprises with heterogeneous structures due to its economic operations, ownership structure, and unique economic position in Iran.

IV. Previous studies have predominantly adopted financial metrics, such as return on assets (ROA), to assess OP (as PMS benefits) (Hoque, 2014). In contrast, this study employed a combination of financial metrics (Return on Capital Employed (ROCE), Return on Sales (ROS), ROA) and a more precise 17-item measure based on management perceptions of PMS benefits (Heinicke et al., 2016; Speckbacher and Wentges, 2012), including net benefits and the costs of PMS implementation and usage.

2. Theoretical and experimental foundation

2.1 Theoretical foundations

2.1.1 Design and sophistication levels of PMS

PMS are integral to organizational management, providing a structured approach to evaluating and improving performance. PMS encompasses various dimensions, including financial, operational, and strategic aspects, collectively contributing to achieving organizational goals. The comprehensive nature of PMS allows managers to align performance metrics with strategic objectives, ensuring that all organizational activities are directed towards common goals (Heinicke et al., 2016; Alamri, 2019).

PMSs encompass a set of financial and non-financial metrics that aid in quantifying information about a company's operations and provide an overview of its performance (Heinicke et al., 2016). They are essentially a part of the management systems exploited as quantitative criteria for the efficiency and effectiveness of operations. The effective implementation of PMSs plays a vital role in gaining a competitive advantage within an organization and is strongly correlated with OP (Alamri, 2019).

Organizations believe that they utilize PMSs by employing a combination of financial and non-financial measures. Kaplan and Norton (2002) suggest that the concept of PMS goes beyond using such measures. Therefore, to investigate existing differences in design, using a continuous scale in the deployment of PMS, it is imperative to consider the impact of the sophistication levels of PMSs on design effectiveness (Heinicke et al., 2016). The term sophistication level of PMS refers to the breadth of essential design features, use, or processes of a specific PMS within a company (Agostino and Arnaboldi, 2012). In other words, the sophistication level of PMSs indicates their technical quality based on design features such as perspectives on financial and non-financial indicators, strategic maps, operational plans, and relationships with incentive systems. This implies that significant differences in the sophistication level of PMSs can be observed in the degree of correlation between performance indicators and strategy, the explicit description of strategy using causal relationships, and the correlation of management performance with incentive systems (Heinicke et al., 2016).

The theoretical literature proposes two approaches to the sophistication level of PMSs. According to Speckbacher and Wentge's (2012) approach, PMS is generated across a continuous time spectrum (sequential sophistication levels), emphasizing the consideration of developmental stages in PMSs (Speckbacher and Wentges, 2012). Regarding the second approach, Franco-Santos et al. (2012) rejected the necessity of a linear relationship between the sophistication levels of the PMSs. Both approaches describe the design elements of PMSs to inform managerial decision-making and evaluate OP, and they agree that the content, implementation, and expected PMS benefits may vary based on their types (Heinicke et al., 2016). As Alamri (2019) asserts, implementing management accounting system approaches in results-oriented (diagnostic) organizations is not limited to financial functions, and managers have incentives to implement management accounting approaches in other functions. Endrikat et al. (2020) conducted a meta-analysis of 25 empirical articles to detect the impact of PMSs on OP. They reported high heterogeneity in the findings of the studies, attributed to the type of PMS design and functionality. Furthermore, when PMSs are based on organizational capabilities, the effect size is larger than the financial criteria, indicating the importance of the OP measurement method for capturing the impact of PMSs (Heinicke et al., 2016).

2.1.2 Types of PMS use

In addition to the design (sophistication level) of PMSs, different types of use also affect the outcomes of PMSs (Bedford et al., 2023a; Bedford et al., 2023b; Heinicke et al., 2016; Koufteros et al., 2014). For Example, Bedford et al. (2023b) suggest that the design features and differentiation of PMS use affect an organization's operational outcomes. They reported that a PMS with a broad scope led to more pleasant outcomes, while an integrated PMS lowered OP. Another study documented PMS design's effective and potential impact on organizational outcomes (Bedford et al., 2023a). Cupertino et al. (2023) state that the type of function and complexity of the PMS positively affect the organization's performance and sustainability in the short term and firms could be concurrently sustainable and profitable in the short run. In this context, the distinction between interactive and diagnostic use within the LoC framework (Simons,1995, 2014) facilitates a more precise understanding of the relationships between different uses, various sophistication levels, and PMS benefits.

Simons (2014) defined cyber-logic-based diagnostic controls (how to control complex systems) as any formal information system used to set goals, measure outputs, calculate and evaluate performance deviations, and provide feedback to adjust inputs or processes to align performance with prespecified objectives and standards. Thus, the diagnostic use of PMSs represents a control mechanism for tracking, examining, and achieving predictable goals (Mura et al., 2021). As measurement systems are generally designed to monitor and modify deviations from predefined objectives and implement desired strategies, this function acts as traditional feedback (Bititci et al., 2018; Heinicke et al., 2016; Mura et al., 2021). In this regard, several researchers have argued that the diagnostic use of PMS is a restraining force because it focuses on errors and negative deviations through single-loop learning (Mura et al., 2021; Henri, 2006). In contrast, diagnostic use facilitates a better understanding of processes and current performance, contributing to cost and time reduction and continuous improvement (Mura et al., 2021). In this case, preliminary evidence suggests a positive effect of diagnostic PMSs on the performance of companies that exploit existing market opportunities and technological capabilities (Bedford et al., 2023a). More specifically, diagnostic use enables the achievement of goals such as promoting the quality of existing products and current processes by posing limitations, setting continuous improvement through single-loop learning, and contributing to innovative process management (Müller-Stewens et al., 2020).

In contrast, interactive controls are "formal information systems that managers use to participate personally in employees' decision-making activities of employees" (Simons, 2014), with a focus on identifying new strategies. In other words, interactive PMSs address strategic uncertainty and facilitate the emergence of new strategies, whereas diagnostic PMSs concentrate on critical performance criteria and contribute to implementing existing strategies (Simons, 2014). This researcher believes in the association between achieving goals and incentives through diagnostic controls, as it enables the attainment of goals set by management (Bedford et al., 2023a).

As most MC studies rely on the LOC framework to distinguish between various PMS uses (Agostino and Arnaboldi, 2012; Franco-Santos et al., 2012; Heinicke et al., 2016; Henri, 2006; Mura et al., 2021), some researchers propose that a combination of different PMS uses can help organizations balance competitive goals; Mura et al. (2021), for example, mentioned that diagnostic control, aiming to ensure the achievement of predetermined goals by the organization, may positively affect the efficiency of new product development processes in Research and Development (R&D) enterprises, while interactive control, aiming to seek opportunities (searching for behaviors among individuals and operations), may positively affect creativity. In their meta-analysis, Bellora-Bienengräber et al. (2023) proved using a combination of PMS use types by enterprises. Moreover, they found that their types of use are linked to performance through organizational capabilities. Given the mutual dependence between levers, Bedford et al. (2023a) claimed that both diagnostic and interactive use have joint effects on performance depending on the enterprise's desired innovation.

Mura et al. (2021) suggested that diagnostic PMSs positively reduce the total costs and time spent performing activities, introduce new products, and expand the diverse range of products. According to their study, the diagnostic PMS is more appropriate if an organization primarily pursues operational goals. Diagnostic-interactive PMS is more effective if the organization's goals are simultaneously operational and exploratory. In another study, Rajnoha et al. (2016) indicated that diagnostic use has a positive impact on financial performance criteria and the interactive use of non-financial performance criteria concerning strategic management innovations and in the other study Dubey et al. (2017) said to achieve sustainable performance the organization must embrace hybrid orientation which is a fine blend of interactive and diagnostic systems. In contrast, Henri (2006a) found a negative relationship between monitoring (i.e., diagnostic PMS) and measurement diversity (i.e., measuring the sophistication levels of PMS), arguing that diagnostic control is strongly correlated with financial information and budget control and is only required at the high sophistication level of PMS to a limited extent. He also suggests that interactive PMSs, focusing on strategic priorities and dialogue, reinforce strategic choices and that diagnostic PMSs impose constraints to ensure compliance with regulations and apply negative pressure on strategic choices. Some of his findings also illustrate the effect of dynamic inconsistency resulting from the balanced use of diagnostic and interactive PMSs on performance. Similarly, Micheli and Manzoni (2010) asserted that improperly implementing a PMS can be highly destructive for OP and that PMSs can be both effective and ineffective for companies, with the PMS design and its implementation procedure determining organizational outcomes. This highlights the need to examine the exclusive effects of diagnostic and interactive use and their fit on OP. According to the foundations mentioned above, the distinction between diagnostic and interactive use is a suitable solution for examining the sample and analyzing the outcomes; hence, the present study took advantage of this method.

2.2 Research hypotheses

The organizational control theory (CT) suggests that the diagnostic function of PMS enables managers to accurately assess employee performance and identify strengths and weaknesses. This precise evaluation can improve overall OP, as managers can make better resource allocation and employee development decisions. Empirical studies have shown that using PMS for accurate performance evaluation can increase employee motivation and productivity. For instance, Sarstedt et al. (2020) found that organizations using PMS for precise performance assessment significantly improved employee productivity and job satisfaction.

Organizational learning theory emphasizes that the interactive function of PMS facilitates the exchange of information and knowledge between employees and managers; these interactions can lead to improved work processes and innovation, as employees can benefit from each other's experiences and knowledge, finding more creative solutions to problems. Empirical studies have also shown that positive interactions between employees and managers can increase job satisfaction and reduce turnover rates. For example, a study by Johnson et al. (2019) found that organizations using interactive PMS had lower turnover rates and higher employee job satisfaction.

Organizational complexity theory posits that more complex systems can provide more accurate information, helping managers make better decisions. These systems can process more data and offer more detailed analyses, allowing managers to evaluate employee performance comprehensively. Empirical studies have shown that more complex systems can improve the accuracy of evaluations and increase managers' confidence in decision-making. For instance, Brown et al. (2021) found that organizations using more complex PMS made better employee development and resource allocation decisions.

Open systems theory suggests that more complex systems can facilitate greater interactions between different parts of the organization, leading to improved coordination and collaboration. These systems can share more information across departments, enabling employees to work together more effectively. Empirical studies have shown that more complex systems can lead to increased innovation and improved work processes.

Organizational scale theory suggests that in larger companies, the complexity and diversity of tasks are greater, and the diagnostic function of PMS alone may not cover all aspects of performance. Larger companies require more comprehensive and multidimensional systems to evaluate performance accurately. Empirical studies have shown that larger companies need more comprehensive and multidimensional systems for performance evaluation. For instance, a study by Mura et al. (2021) found that simpler PMS could not adequately assess employee performance in larger companies, necessitating more complex and comprehensive systems.

Organizational network theory posits that interactions between different departments and units in larger companies are more critical, and the interactive function of PMS can help improve these interactions. Larger companies require more coordination and collaboration between departments and units, and interactive PMS can help enhance this coordination and collaboration. Empirical studies have shown that in larger companies, interactive systems can improve coordination and collaboration between units, leading to greater benefits. For example, a study by Alamri (2021) found that interactive PMS improved coordination and collaboration between units in larger companies, resulting in greater benefits.

Underpinned by the theoretical foundations and raised ambiguities, the following research hypotheses were proposed to address the research questions:

H_1: The diagnostic use of PMS significantly affects its benefits.

H_2: The interactive use of PMS significantly affects its benefits.

H_3: The sophistication level of PMS significantly affects the benefits of its diagnostic use.

H₄: PMS's sophistication level significantly affects the benefits of its interactive use.

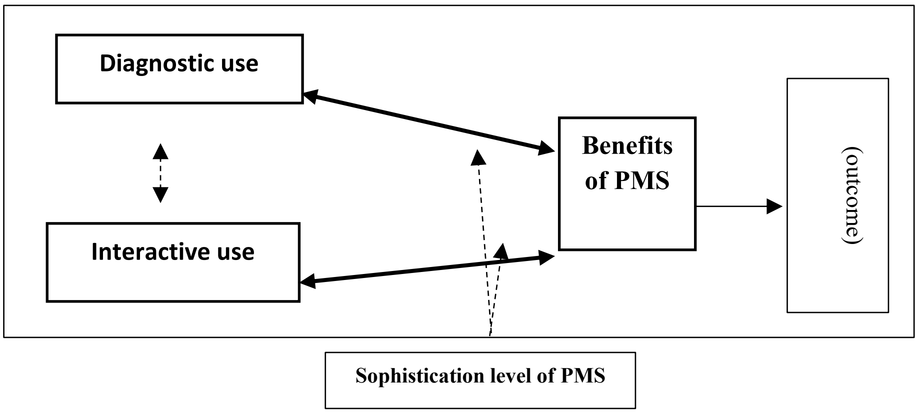

Figure 1. The conceptual model used in this study

According to Figure 1, the proposed model focuses on the relationships between different types of PMS use with benefits and OP, the effect of PMS sophistication levels on this relationship, and the relationships between types of PMS use. Moreover, multi-group analysis and control variables were considered to examine the effects of contingency factors as contextual variables.

3. Research methodology

3.1 Research model

PMS benefits can be explained by its type of use and sophistication levels (Heinicke et al., 2016).

$$Benefit = \beta_0 + \beta_1(diagnostic\ use - PMS\ sophistication\ level)^2 + \beta_2(interactive\ use - PMS\ sophistication\ level)^2 + \varepsilon \quad (1)$$

If all relationships among the direct, intervening, and squared variables are considered in the proposed model, the following equation is obtained:

$$Benefit = \beta_0 + \beta_1\ diagnostic\ use + \beta_2(diagnostic\ use)^2 + \beta_3\ interactive\ use + \beta_4\ (interactive\ use)^2 + \beta_5 PMS\ sophistication\ level + \beta_6(PMS\ sophistication\ level)^2 + \beta_7(diagnostic\ use * PMS\ sophistication\ level) + \beta_8(interactive\ use * PMS\ sophistication\ level) + \sum controls + \varepsilon \quad (2)$$

where,

$Benefit$: Benefits of PMS

$diagnostic\ use$: diagnostic use of PMS

$interactive$use: Interactive use of PMS

$PMS\ sophistication\ level$: PMS sophistication levels

First, data collection instruments were assessed, the conceptual model was estimated, and then the diagnostic and interactive uses of PMSs and PMS benefits were quantitatively validated. To this end, exploratory factor analysis was employed for the preliminary validation of the diagnostic and interactive use of PMSs using SPSS software version 26. Confirmatory factor analysis was performed using Smart PLS 3 software to confirm the findings of the exploratory factor analysis.

Finally, a structural model for the diagnostic and interactive use of PMSs was validated.

In the next phase, the conceptual research model was estimated. Structural equation modeling (SEM) based on partial least squares was used to test the research hypotheses. The conceptual model estimation coefficients and their significance were assessed, including second-order factors. Furthermore, a conceptual model without second-order factors was estimated to test the model's robustness, and the coefficients' significance was evaluated. The validity of the estimated model was explored before testing the research hypotheses. Subsequently, a multi-group analysis was run.

Multi-group analysis was run using Smart PLS software to detect significant differences in the coefficients obtained for the two groups.

In the final phase, the reliability of the results was assessed by examining the conceptual research model without second-order factors under different conditions. Table 1 shows the measurements of the research variables.

Table 1. Measurement of research variable

Variable	Symbol	Instrument and scoring scale	Reference
Benefits PMS	BePMS	1. The OP questionnaire with 17 items scored on a five-point Likert scale: Participants are asked to report the expected PMS benefits on a five-point Likert scale, with the obtained score (benefits) indicating the weighted average importance (agreement level) of each section of the mentioned benefits. 2. Confirmatory factor analysis with a second-order structure consisting of three factors (ROCE, ROS, and ROA) was used to measure the reliability of the items.	Heinicke et al. (2016)
Diagnostic use of PMS	InPMS	A five-point Likert scale questionnaire: The items determine classical indicators such as supervision, inspection, and comparison.	Henri (2006a)
Interactive use of PMS	DPMS	A five-point Likert scale questionnaire: The interactive use items determine focused attention.	Henri (2006b)
Sophistication levels of PMS	SoPMS	A five-point Likert scale questionnaire: Participants are asked to fill in a four-part questionnaire that determines various types of PMSs and encompasses key performance measures in different dimensions, causal relationships, defined goals, operational plans, and links to incentives. They are also supposed to determine the extent of their PMS's effectiveness on a five-point Likert scale with regard to the four mentioned components.	Heinicke et al. (2016); Speckbacher and Wentges (2012)

3.2. Research population and sample

The research population encompasses all employees and specialist managers in Gulf Petrochemical Holding, including CEOs, deputies, consultants, financial managers, and budget managers, of which 46 petrochemical companies were selected as the research sample (see Appendix). Subsequently, 384 questionnaires were randomly distributed among the participants, and 295 were completed and returned. Table 2, presents descriptive statistics of the participants' demographic characteristics.

4. Findings

4.1 Inferential statistics, validation of data collection instruments, and conceptual model estimation

4.1.1 Quantitative validation of research variables

Factor analysis was run to validate the diagnostic and interactive use of PMSs.

4.1.1.1 Exploratory factor analysis of research variables

To measure the diagnostic and interactive use of PMSs, a 9-item scale was employed to extract

PMS benefits, including 17 items in the questionnaire. Exploratory factor analysis using principal component analysis (PCA) was performed to classify the indicators. In the first phase of the exploratory factor analysis, the Kaiser-Meyer-Elkin (KMO) criterion and Bartlett's test of sphericity were used to assess sampling adequacy, indicating acceptable sampling adequacy for all variables ($p<0.01$) (Table 3).

Table 2. Demographic characteristics of participants

Characteristic	Classification	Frequency
Work experience (years)	<5	5
	5-10	27
	10-15	64
	15-20	117
	20-25	49
	>25	33
Education level	Diploma	5
	BA	85
	MA	112
	PhD	92
	Missed data	1
Organizational position	Manager	22
	Head	64
	Supervisor	84
	Specialist	123
	Missed data	2
Field of study	Accounting	81
	Finance Management	50
	Chemical Engineering	61
	Other Engineering disciplines	102
	Missed data	1

The number of hidden factors was determined regarding eigenvalues (Table 4). Regarding diagnostic and interactive use, two factors have eigenvalues >1, suggesting that the proposed model contains two hidden factors explaining approximately 80.5% of the variance. According to Figure 2, Considering PMS benefits, there are three factors with eigenvalues >1, indicating the number of hidden factors in the proposed model (n=3), which explains approximately 82% of the total variance. Table (5) shows the hidden factors of the research variables obtained using PCA and varimax rotation.

Table 3. Sampling adequacy test of research variables

diagnostic and interactive use of PMSs	KMO		0.896
	Bartlett's test	Chi-square	2441.093
		Df	36
		Sig.	0.000
PMS benefits	KMO		0.948
	Bartlett's test	Chi-square	5546.891
		df	136
		Sig.	0.000

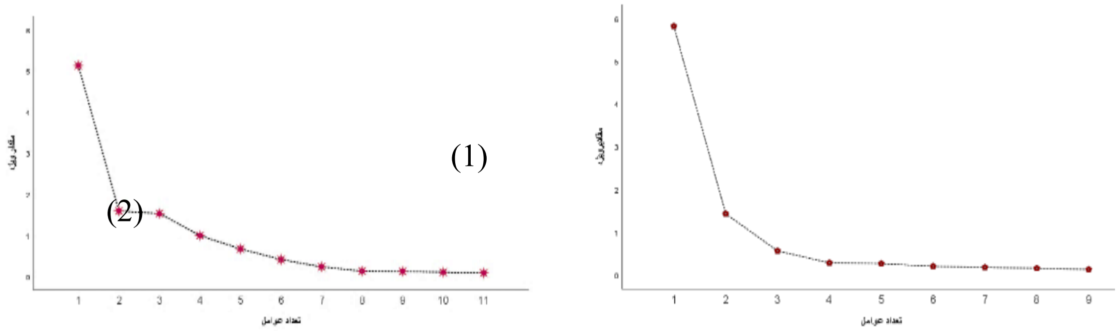

Figure 2. Scree Plots for diagnostic and interactive use (1) and PMS benefits (2)

Table 4. Total variance explained by factors extracted from research variables

variable	**Factors**	**eigenvalues**		
		sum	**Variance (%)**	**Cumulative variance explanation %**
diagnostic and interactive use	1	5.822	64.688	64.688
	2	1.429	15.879	80.566
	3	0.560	6.217	86.784
	4	0.279	3.104	89.887
	5	0.261	2.902	92.790
	6	0.199	2.211	95.001
	7	0.173	1.922	96.923
	8	0.152	1.690	98.613
	9	0.125	1.387	100.000
benefits PMS	1	10.369	60.994	60.994
	2	2.167	12.749	73.743
	3	1.405	8.264	82.007
	4	0.508	2.985	84.993
	5	0.319	1.878	86.870
	6	0.298	1.750	88.620
	7	0.276	1.622	90.242
	8	0.265	1.557	91.800
	9	0.234	1.376	93.176
	10	0.194	1.140	94.316
	11	0.186	1.095	95.410
	12	0.169	0.994	96.404
	13	0.139	0.816	97.220
	14	0.133	0.781	98.001
	15	0.125	0.734	98.735
	16	0.117	0.686	99.420
	17	0.099	0.580	100.000

Tables 5 and 6 present the final structure of the factors in the rotated matrix for the different research variables. The results in this matrix establish the foundation for grouping the variables, according to which some variables with factor loadings >0.6 are assigned to each factor. Then, the extracted factors were developed based on the compiled items and classified according to indicators and theoretical literature.

Table 5. Matrix of rotated factor loadings for diagnostic and interactive use

	Factors	
	interactive use	Diagnostic use
PMS1	0.186	0.896
dPMS2	0.300	0.900
dPMS3	0.336	0.857
inPMS1	0.736	0.289
inPMS2	0.832	0.279
inPMS3	0.880	0.274
inPMS4	0.860	0.260
inPMS5	0.863	0.205
inPMS6	0.879	0.230

Table 6. Matrix of rotated factor loadings for PMS benefits

		Factors	
	Supporting strategy implementation	supporting Stakeholder communication	Supporting operational processes
rbePMS1	0.857	0.363	0.165
rbePMS2	0.809	0.316	0.188
rbePMS3	0.846	0.338	0.146
rbePMS4	0.789	0.384	0.142
rbePMS5	0.798	0.355	0.120
rbePMS6	0.851	0.170	0.193
rbePMS7	0.852	0.083	0.270
rbePMS8	0.814	0.229	0.271
rbePMS9	0.823	0.116	0.256
rbePMS10	0.852	0.085	0.289
rbePMS11	0.285	0.859	0.177
rbePMS12	0.220	0.867	0.129
rbePMS13	0.209	0.865	0.216
rbePMS14	0.271	0.863	0.236
rbePMS15	0.296	0.344	0.805
rbePMS16	0.221	0.304	0.790
rbePMS17	0.311	0.083	0.883

4.1.1.2 Confirmatory factor analysis of research variables

Confirmatory factor analysis ensured the factor structure fits well with the extracted data. Before examining the factor loadings, Cronbach's alpha, average variance extracted (AVE), and composite reliability were used for the model assessment.

In Table (7), Cronbach's alpha index for the extracted hidden diagnostic and interactive use factors is >0.7 for all research variables, suggesting their appropriateness. The composite reliability for diagnostic and interactive use of the proposed PMS was >0.6, confirming its appropriateness. Moreover, AVE was >0.5.

The goodness of fit (GOF) and the root mean square of the residuals were used to assess the whole model. GOF >0.4 and SRMR <0.08 suggest the model is well-fitted. Table (7) confirms the acceptable fit of all models.

Cross-validation was also used to check the quality of the model fit, confirming its acceptable quality, as all variables are positive. Accordingly, the relevant models have acceptable and appropriate reliability.

Table 7. Main quality criteria of research variable measurement models

Variable		Cronbach's alpha	Composite reliability	Mean variance extracted	Cross-validation	GOF	SRMR
Interactive and diagnostic use	diagnostic	0.918	0.948	0.858	0.673	0.4646	0.052
	Interactive	0.942	0.954	0.776	0.682		
PMS benefits	communication	0.942	0.958	0.851	0.729	0.491	0.054
	Strategy	0.970	0.974	0.789	0.738		
	process	0.892	0.933	0.823	0.608		

The Fornell-Larker index was also employed to check for divergent validity. As shown in Tables 8 and 9, the square root of AVE (located in the main diameter of the matrix) for each hidden variable exceeded the maximum correlation of the hidden variable with other hidden variables, indicating the acceptable validity of the proposed PMS.

Table 8. Divergent validity index for interactive and diagnostic use

	diagnostic	interactive
diagnostic	0.926	
interactive	0.564	0.881

Table 9. Divergent validity index for PMS benefits

	communication	strategy	process
communication	0.923		
strategy	0.560	0.888	
process	0.520	0.569	0.907

4.1.2 Conceptual model estimation

The next step involves evaluating the research hypotheses and examining their confirmation or rejection using partial least squares SEM (PLS-SEM) to assess the hypothetical model.

Before testing the hypotheses, we examined the accuracy of the estimated model. Table 10 shows that the Cronbach's alpha for both models' components was >0.7, suggesting their acceptability. The composite reliability for both models was >0.6, confirming their appropriateness. AVE is also > 0.5. The Fornell-Larcker criterion was used to examine divergent validity, demonstrating the appropriateness of the proposed PMS model (Tables 11 and 12).

Table 10. Main quality indices of conceptual model measurement

	Cronbach's alpha	Composite reliability	Ave	Cross validation
Diagnostic use	0.918	0.948	0.858	0.673
Interactive use	0.942	0.954	0.776	0.684
Benefits	0.977	0.979	0.737	0.703
Sophistication	0.800	0.873	0.639	0.431

Table 11. Divergent validity index

	Diagnostic use	Interactive use	benefits	Sophistication
Diagnostic use	0.926			
Interactive use	0.563	0.881		
benefits	0.438	0.670	0.858	

Sophistication	0.542	0.707	0.726	0.799

Table 12. Summary of structural model estimation results

Independent Variable	Dependent Variable	Hypothesis	Expected Relationship	Model with Second-Order Factors		Model without Second-Order Factors	
				Coefficient	Statistics- t	Coefficient	Statistics- t
Diagnostic use	benefits	First	positive	-0.184	0.555	-0.016	0.266
Interactive use	benefits	Second	positive	0.637	2.136	0.313	6.098
Diagnostic use - Second Order	benefits			0.186	0.550		
Interactive use - Second Order	benefits			-0.345	1.228		
Interaction between Diagnostic use and Sophistication	benefits	third	positive	0.040	0.584	0.048	0.975
Interaction between Interactive use and Sophistication	benefits	Fourth	Positive	0.065	0.832	-0.035	0.799
Diagnostic use	Interactive use			0.536	13.463	0.563	14.209
Diagnostic use	Sophistication level			0.210	3.649	0.210	3.614
Interactive use	Sophistication level			0.589	12.527	0.589	12.389
Sophistication level	benefits			0.939	2.876	0.508	9.765
Sophistication level - Second Order	benefits			-0.480	1.376		
Benefits	OP			0.205	3.753	0.205	3.339
Coefficient of Determination				0.368		0.367	
GOF				0.4787		0.4779	
SRMR				0.071		0.063	

4.2 Testing research hypotheses

H_1 and H_2: Diagnostic (interactive) use of PMS significantly affects its benefits.

The results of the conceptual model estimation in Table (12) indicate the path coefficient between the diagnostic use of PMS (interactive use of PMS) and their benefits to be -0.184 (0.637) in the model with a second-order factor. Regarding the significance of the coefficient, t=0.555 (2.136), indicating no significant effect of PMS diagnostic use on its benefits. By contrast, the interactive use of PMS has a significant and positive effect on its benefits. Accordingly, the first hypothesis was rejected, and the second research hypothesis was confirmed. Similar results were obtained for the research model estimation without second-order factors and model estimation with second-order factors.

H_3 and H_4: The sophistication level of PMS significantly affects the benefits of its diagnostic (interactive) use.

Table (12) shows that the path coefficient representing the interaction between diagnostic (interactive) use and sophistication level with PMS benefits is 0.040 (0.065). Moreover, t= 0.584 (0.832), less than the critical t-statistic values at p=0.1, p=0.05, and p=0.01, implies that the sophistication levels of PMS have no significant effect on the relationship between diagnostic and interactive use and their benefits. Accordingly, the third and fourth research hypotheses are rejected. Similar results were obtained for the research model estimation without second-order factors and model estimation with second-order factors. The other results for the conceptual model estimation indicated a positive and significant relationship between diagnostic and interactive use (e.g., path coefficient=0.563 and t= 14.209 in the model without a second-order factor). A positive and significant relationship exists between diagnostic use and sophistication level (e.g., path coefficient=0.210 and t= 3.614 in the model without a second-order factor). There is also a positive and significant relationship between interactive use and sophistication levels (e.g., path coefficient=0.589 and t= 12.389 in the model without a second-order factor) and between sophistication levels and PMS benefits (e.g., path coefficient=0.508 and t= 9.766 in the model without a second-order factor). Moreover, a positive and significant relationship exists between benefits and performance (e.g., path coefficient=0.205 and t= 3.339 in the model without a second-order factor).

4.3 Sensitivity analysis and results stability assessment

To assess the stability of the obtained results, the conceptual research model was estimated without second-order factors in the different scenarios (Table 13). As shown in this table, Model 1 is the same as the conceptual research model without second-order factors, with the difference that a second-order factor structure supporting strategy implementation, stakeholder communications, and operational processes are used for benefits.

Model 2 is the same as the conceptual research model without second-order power factors, with the difference that the strategy dimensions are not included for PMS benefits.

Model 3 is the same as the conceptual research model without second-order factors, with the difference that the strategy dimensions are not considered for the sophistication levels of PMS.

Model 4 is the same as the conceptual research model without second-order power factors, with the difference that the strategy dimensions are not assumed for both sophistication levels and PMS benefits.

As can be observed, almost in each of the four models, the results are similar to those of the original model, that is, the conceptual research model without second-order power factors, thereby confirming the stability of the results in different scenarios.

Furthermore, the conceptual model without second-order power factors was estimated by using additional independent variables (Table 14). The added independent variables are corporate size (number of employees) in Model 5, corporate size (logarithm of company sales) in Model 6, OP based on the second-order factor structure in Model 7, and OP based on ROS in Model 8. In Table 14, almost in each of the four models, the results are similar to the original model, that is, the conceptual research model without second-order power factors, thereby confirming the stability of the results in different scenarios.

Table 13. Model estimation in different scenarios

Independent Variable	Dependent Variable	Model without Second-Order Factors		Model1		Model 2		Model 3		Model 4	
		Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Diagnostic Use	Benefits	-0.000	0.260	-0.016	0.275	-0.055	0.924	-0.024	0.416	-0.064	1.110

Interactive Use	Benefits	0.310	6.090	0.312	6.119	0.283	5.121	0354	6.799	0.332	5.530
Interaction between Diagnostic Use and Sophistication	Benefits	0.040	0.970	0.048	1.036	0.034	0.722	0.068	1.502	0.046	0.970
Interaction between interactive Use and Sophistication	Benefits	-0.030	0.790	-0.03	0.780	-0.01	0.234	-0.01	0.39	0.02	0.450
Diagnostic Use	interactive Use	0.560	14.20	0.563	14.42	0563	14.44	0.563	15.00	0.56	13.600
Diagnostic Use	Sophistication	0.210	3.610	0.210	3.620	0.206	3.594	0.246	4.52	0.24	4.150
interactive Use	Sophistication	0.580	12.30	0589	1307	0.592	12.71	0.548	12.13	0.55	11.480
Sophistication	benefits	0.500	9.760	0.509	9.436	0.541	9.674	0.45	8.36	0.47	8.150
benefits	OP	0.200	3.330	0.204	3.167	0.193	3.583	0.20	3.29	0.19	3.300
Coefficient of determination		0.367		0.475		0.361		0.359		0.352	
GOF		0.477		0.543		0.475		0.450		0.448	
SRMR		0.063		0.068		0.069		0.066		0.073	

5. Discussion and conclusion

The present study contributes to the relevant literature by expanding empirical evidence on the effect of managers' emphasis on a specific type of PMS and its design on the consequent benefits and OP. The required data were collected in 2022 using a questionnaire and analyzed based on the Line of Control (LOC) and CT in 46 companies affiliated with the Petrochemical Holding of the Persian Gulf. The findings reveal that managers' emphasis on the interactive use of PMS significantly positively affects its benefits. This means that PMS benefits are enhanced as managerial controls shift towards social controls based on dialogue, creativity, and innovative strategies. A positive and significant relationship exists between interactive use and the sophistication levels of PMS; however, greater emphasis on interactive use does not necessarily result in greater benefits, implying that the benefits of emphasis on interactive use are not contingent on the sophistication level of PMS.

Table 14. Conceptual model estimation with added independent variables

Independent Variable	Dependent Variable	Model 5		Model 6		Model 7		Model 8	
		Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Diagnostic Use	Benefits	-0.013	0.219	-0.016	0.258	-0.028	0.465	-0.023	0.398

Interactive Use	Benefits	0.309	5.771	0.305	6.065	0.313	6.224	0.309	6.404
Interaction between Diagnostic Use and Sophistication	Benefits	0.044	0.907	0.048	0.949	0.043	0.921	0.041	0.883
Interaction between interactive Use and Sophistication	Benefits	-0.039	0.878	-0.029	0.674	-0.019	0.444	-0.019	0.443
Diagnostic Use	interactive Use	0.563	14.378	0.551	13.638	0.555	13.018	0.550	13.945
Diagnostic Use	Sophistication	0.210	3.720	0.211	3.681	0.205	3.523	0.207	3.539
interactive Use	Sophistication	0.588	12.618	0.585	12.136	0.586	12.307	0.583	13.09
Sophistication	benefits	0.511	9.467	0.504	9.597	0.495	9.740	0.497	9.521
benefits	OP	0.205	3.276	0.205	3.211				
added independent variable	Sophistication	-0.006	0166	0.017	0.504	0.044	1.066	0.043	1.207
	benefits	-0.049	1.236	0.045	1.202	0.089	2.029	0.309	1.969
	Diagnostic Use	-0.008	0.135	0.089	1.787	0.157	2.438	0.146	2.297
	interactive Use	-0.057	1.205	0.113	2.785	0.050	0.760	0.088	1.910
Coefficient of determination		0.368		0.372		0.366		0.366	
GOF		0.478		0.481		0.476		0.477	
SRMR		0.063		0.064		0.063		0.060	

Since diagnostic use had no effect on PMS benefits and given the significant relationship between sophistication levels and interactive and diagnostic use, and because one component of sophistication links key performance measures to incentives, the present study's findings are consistent with the LOC framework. Similarly, Simons (2014) explained the relationship between diagnostic use and reward systems. In the present study, although the impact of diagnostic use on PMS benefits was not statistically confirmed, the significant relationship between diagnostic and interactive use indicates an overlapping effect. Considering the significant effects of the sophistication levels of PMS on its benefits, the emphasis on a specific use may bring about effective or ineffective outcomes in terms of PMS benefits, possibly explaining the ambiguous and contradictory results. Bellora-Bienengräber et al. (2023) and Cupertino et al. (2023) reported the same findings; however, the findings contrast with those of Bedford et al. (2023b) and Heinicke et al. (2016) regarding the relationship between diagnostic (interactive) use and PMS benefits. Given the compatibility of the sophistication level with the effect of PMS benefits, the findings align with Alamri (2019) findings and contrary to Heinicke et al. (2016).

Irrespective of the significance of PMS for organizational benefits, given that the emphasis on interactive use is associated with greater benefits, the nature of the interactive use of PMS focuses on strategic uncertainty, facilitates the emergence of new strategies, and positively promotes creativity by offering opportunities (searching behavior among individuals and activities), petrochemical managers should consider both types of use in the pursuit of greater benefits and promote OP. They can also adopt the present findings, focusing more on interactive use to gain benefits and enhance OP. This recommendation is in line with the nature of the operations in such companies, where new competitive strategies and employee creativity underpin their success and competitive advantage. Moreover, given the insignificant effect of diagnostic use on benefits, managers are recommended to adjust for such an effect by linking diagnostic goal achievement to incentives. As Simons (2014) argues, incentive systems support diagnostic use within the LOC framework. Because diagnostic use focuses on crucial performance metrics, there is mutual dependence between levers, and both types of use have some interactive effects on OP. In this case, this finding can help managers achieve predetermined goals. Furthermore, senior management can further train supervisors in effective communication and interpersonal relationships, implement transparent damage compensation plans, and highlight the significance of nurturing corporate culture, thereby opening an avenue for achieving set goals.

Managers should emphasize the interactive function of Performance Management Systems (PMS), as findings indicate that this function significantly enhances the benefits of PMS. This includes using social controls, dialogue, creativity, and innovative strategies. Emphasizing the interactive function can facilitate the emergence of new strategies and create new opportunities for the organization. The benefits of emphasizing the interactive function are not contingent on the complexity level of the PMS. Therefore, managers can focus on the interactive function without concern for system complexity. Given the lack of confirmed effects of the diagnostic function on PMS benefits, managers can create more positive impacts by linking the achievement of diagnostic goals with incentives. This approach can help improve OP. The findings show that emphasizing the interactive function is equally effective in both large and small companies. Therefore, managers of any company size can benefit from this approach. Senior management can improve OP by allocating more resources to training supervisors in effective communication and interpersonal relationships, implementing transparent compensation schemes and performance evaluation systems, and promoting corporate culture. These implications can help managers in the Persian Gulf Petrochemical Holding leverage the present study's findings to gain more benefits from their PMS and enhance OP.

Besides survey research limitations, this study, like other cross-sectional studies, suffered from some limitations, as it only addressed the relationships and disregarded causality. Moreover, the sampling and analysis of the results were conducted in full accordance with the methodological standards; however, the generalization of the findings to companies operating in other industries or with different legal natures is limited due to the quality of the collected data and the limitations of questionnaires.

In conclusion, researchers have explored the effect of other contextual variables, such as type of ownership, corporate governance, structure, and organizational context, on the relationships of the aforementioned variables within the framework of CT in combination with other theories, such as Giddens' structuration theory. Finally, future researchers may detect the synergies of economic control mechanisms (e.g., the LOC framework) and the effectiveness of other control levers in companies operating in different industries or the context of the digital economy using suitable methodologies, such as quantitative approaches.

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