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# The Influence of the External and Internal Factors on the Adoption of the Performance measurement System in the Construction Industry in Yemen

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**Abstract.** This study was conducted for testing the hypothesis of the relationship between contingency and institutional variables and the adoption of the performance measurement system (PMS) in the construction industry in Yemen. These variables were ordered as external and internal contextual factors that facilitate or hinder the adoption of the modern managerial account systems such as PMS. A survey questionnaire was deployed in this study to gather the data from the largest construction firms representing classes 1, 2, and 3. Then, 104 were returned and usable questionnaires were used for the analysis by employing Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 0.3 software. The results show that the stakeholder involvement has the highest impact on the adoption of PMS whereas environmental uncertainty has no effect at all. In addition, leadership, information system, and quality management practices have significant positive effects, while the competition and strategy have significant but negative impacts on the adoption of PMS in construction firms in Yemen. Based on the findings, some implications have been drawn for promoting the adoption of performance measurement system in organizations in developing countries, including Yemen.

## 1. Introduction

Adopting the performance measurement system (PMS) is claimed to be one of the optimum measures introduced in different industries and sectors of many countries. In many sectors, adopting PMS as an important component of management reform and industries has spread widely recently. Mostly, PMS contributes significantly in the efficient and effective management, therefore, adopting PMS has become a critical matter on the public and academic platforms [1, 2]. Practically, despite the great potential benefits of PMS for the organizations, some firms are facing challenges in the adoption, which may lead to either failure or at least achieving incomplete benefit [3].

Accordingly, former scholars argued that better understanding of the elements that lead to PMS adoption and implementation will increase the chance of higher adoption and implementation success rates [1, 4, 5]. Alike, prior literature studied the performance measurement system in several countries and different industries. They aimed to investigate the factors, motivations, or the obstacles facing the adoption or effective implementation of this system. For instance, [6] conducted researches on the public sector in the United Arab Emirates. The author investigated the influential factors in the successful implementation of PMSs. Furthermore, [7] studied the structure of corporate governance as a PMS contingency factor in Indian and Italian small and medium enterprises (SMEs) applying



various case-study approaches. In addition, [8] studied the factors influencing the significance, scope, and objectives of PMS in both m-commerce and e-commerce firms in Hyderabad, India. In like manner, in a firm's adoption of a performance measurement system, there is a wide range of influential factors [9]. The authors concluded that only a limited number of internal and external factors could affect the adoption of PMS.

However, the vast majority of empirical studies have focused on the general analysis of the implementation of some PMS tools, such as balanced scorecard (BSC), its characteristics and the results of its application [10], while investigating the external and internal environment factors influencing the adoption of PMS in organizations is an issue that has been dealt with less. Despite a large number of books, articles, etc., which have dealt with PMS from different perspectives and for different areas and the wide range of information technology (IT) solutions that have been developed in recent years, there is a dearth of theoretical and empirical studies in the construction industry on external and internal environment factors affecting the adoption of PMS. Similarly, to prior studies [9], this paper has ordered the factors into two main categories i.e. external and internal. The aim of this study is to investigate the effect of the contingency and institutional factors namely environmental uncertainty (EU), competition (CO), and stakeholder involvement (SIN) as external factors, as well as leadership (LS), strategy (ST), information system (INS), and quality management practices (QM) as internal factors. The model of this study and hypotheses were tested using a sample of 104 construction firms in Yemen. Furthermore, this study contributes to the literature in two ways. First, this study provides evidence on the combination of contingency and institutional factors influencing the adoption of PMS in construction industry. Second, much of the PMS literature was published outside Yemen. With regard to differences in the results in countries, it was of interest to the authors to compare the similarity of the results of this study to the results recorded in previous studies, especially of the adoption of PMS.

The remainder of this article is structured as follows to achieve the purpose outlined above: The following section discusses the corresponding literature relating to external and internal factors leading to hypotheses being formed. We then explain the methodology used in this analysis and then present and analyze the findings in more detail in accordance with past studies. We also discuss numerous consequences for the construction industry in Yemen.

## **2. External Variables**

The external variables executed in this paper are a set of factors that are beyond the control of organizations. Organizations can manage these factors by responding strategically to them. The external factors that usually affect adopting new ideas include environmental uncertainty, market competition, and stakeholder involvement. [12], for instance, conceptualized external factors for innovation or adoption of a new opinion, which consists of external support, as well as environmental uncertainty and market readiness. [13] highlighted more factors including new technology, outsourcing, market competition, and the increasing significance of service industries as essential to influence the adoption of new concepts. Similarly, authors asserted that external factors, which are outside the control of organizations, are very essential. Additionally, prior studies asserted that the emergence of new technology has significantly encouraged organizations to foster a quality standard. They also stated that environmental forces affect the adoption of new ideas [14].

Accordingly, in the following sections, this study attempts to explore the effect of environmental uncertainty, competition, and stakeholder involvement as a set of external factors, on PMS adoption.

### *2.1. Environmental Uncertainty*

Environmental uncertainty is the main challenge faced by firms because it affects the quality of decisions and slows the decision-making processes [15]. Environmental uncertainty is defined as the apparent failure of firms to precisely forecast the interests and activities of customers, besides, the lack of ability to predict various circumstances that include the external environment, due to inability to manage the information effectively or because of the lack of correct information. Generally, firms face

environmental uncertainty when they have problems to predict the future precisely. Indeed, prior literature confirmed its effect in several areas. For instance, environmental uncertainty is considered as an important factor in determining public private partnerships, especially in developing countries [14]. Similarly, [16] claimed that perceived environmental uncertainty affects the implementation of balanced scorecard in Vietnam enterprises.

### 2.2. *Competition*

[17] stated that expected competitive advantage has a positive influence on environmental performance measurement system. Also, [18] investigated the link between a multiple performance measurement usage and computer-aided manufacturing processes and an organization's market competition. The results of analysis of 71 New Zealand based business units in manufacturing proposed to put more emphasis on multiple measures for performance measurement is related to businesses confronting high competition and a superior use of computer aided manufacturing processes. Similarly, [19] argued that environmental drivers, such as competition, are essential for adopting innovation in SMEs in Korea. Furthermore, [20] highlighted that intensity of market competition affects positively the use of costing, performance measurement, and budgeting systems in small and medium organizations in Malaysia. However, some studies such as [21] found that organizations tend to adopt PMS regardless of the level of market competition.

### 2.3. *Stakeholder Involvement*

In his study, [22] identified the main drivers of performance information use. The author stated that stakeholder involvement is one of the most important factors that have frequently shown a positive effect. He, also, argued that stakeholder involvement is an essential motivation of performance information use. Moreover, the institutional theory claims that the key cause of strategic change in organizations is not enhancing actual performance but obtaining legitimacy. The shift of organizations' characteristics, therefore, are motivated by external reasons that are legitimizing or political, rather than technical or rational ones [23][24]. To illustrate, [17] claimed that the perceived stakeholder concern affects the use of environmental measurement system for decision-making purpose. Furthermore, [25] stated that external pressures promote the collection of performance measurement in US local government.

The following hypotheses are brought forward in view of the above discussion:

Hypothesis 1(H1): Environmental Uncertainty positively affects PMS adoption in the construction industry.

Hypothesis 2 (H2): Competition positively affects PMS adoption in the construction industry.

Hypothesis 3(H3): Stakeholder Involvement positively affects PMS adoption in the construction industry.

## 3. **Internal Variables**

The internal variables are a collection of controllable elements that positively or negatively affect the efficiency and work environment of the organization. This form of factor analysis is popular in the academic and professional communities. Some research either tackled one or more variables in groups or separately. In accordance with this study, the factors are placed in one set as an internal variable. Prior literature named them diversely as the organizational, internal, or intrinsic variables. [26] studied the organizational factors that influence PMS in South East Asia's higher education institution. Similarly, [27] considered the organizational determinants to be a barrier to the adoption of a BSC in Pakistan for performance evaluations. The authors claimed that organizational factors in a specific organization are those attributes that are considered a major hindrance in strategic adoption-related decision taking. It is believed that these organizational variables are under its control and function as obstacles to BSC adoption. In the previous research studies, several internal factors were investigated which affects the adoption and use of a performance measurement system. Some of these factors are management style and dedication of leadership, organizational culture, technology, and management

systems [9]. This research explores the influence of internal factors (e.g. leadership, strategy, information system, and quality management practices) on the adoption of PMS in the construction industry. Further details are presented in the following sections on those relationships.

### 3.1. Leadership

Leadership is the crucial motivator for any team (or community) of people working together to accomplish specific objectives or any activity that requires all participants to collaborate. Many studies have identified that, in construction, leadership is even more important [28]. Good leadership is an important element for the productive output of any business sector including the construction industry [29]. [30] declared that leadership is the process of directing others to accomplish shared objectives. Authors also stated that leadership is perceived as a psychological phenomenon (i.e. the leader is an individual who possesses some desirable personality and demographic traits), or a sociological phenomenon (i.e. the leader is the result of the integration of an individual, a group and the needs resulting from a situation faced by each). Prior scholars claimed that managers typically have a major impact on the organization's embrace of innovation and, in particular, the adoption of contemporary management accounting systems [16, 31]. Additionally, [32] argued that, in Vietnamese firms, the lack of leadership support has a negative impact on the effective use of activity-based costing processes. In addition, [33] reported that the top Management support is one of the factors that influence the effectiveness of the implementation of accounting information systems in organizations to enhance organizational efficiency. In particular, previous literature verified that leadership is a major contributor to the positive adoption and implementation of PMS [34] and it has clear correlation with the comprehensive performance measures [35]. Similarly, in developing an advanced managerial strategy in India, [7] proved the key role of leadership as an aspect of corporate governance.

### 3.2. Strategy

Measuring performance is an integral part of the Strategic Management Process. [36] stated that assessing progress is a popular way of evaluating the degree to which policy has been adequately applied within an enterprise. Organizations should adapt their assessment of their success to their approach. Scholars outline the organizational role of the strategy. They explained that organizations need to set clearly specified priorities and then assign sufficient resources to achieve those goals [37]. Ideally, a PMS should be aligned with the strategy of the company, but the literature indicates that the question of aligning it with the strategy through the enterprise is a key issue. Therefore, it is important that the organization clearly identifies its global goals and communicate them effectively within the organization before the PMS is created. To mitigate the risk of opposition, both parties need to consider the importance of the performance metrics and the rationale for their use. In addition, many scholars such as [38], have discussed how ambiguous strategy results in poorly specified Critical Success Factors (CSF) and Key Performance Indicators (KPI), which then affect the system's reputation, potentially make it inefficient or even irrelevant. Empirical proof acquired from the work carried out on this subject has shown that the BSC, as a system of performance evaluation and control, takes into account the alignment between management metrics and the organizational strategy, as one of the keys to effective implementation [5][10]. The literature on performance measurement indicates that while a performance measurement method is important in all businesses; different business environments need specific measures to determine the effectiveness of firms [37]. The related literature suggests that organizations are using certain types of indicators that suit their policy, organizational structure, and environmental uncertainty. The type of strategy that a firm employs will influence the design of performance measurement system [39]. Similarly, the research carried out by [37] suggested that the key reasons for PMS adoption failure were shortcomings in the organizations' mission and vision, and coordination of this within the organization.

### 3.3. Information System

The information system has a central role in the process of managing and communicating performance. A management information system (MIS) is defined as a system that deals with planning, developing, managing, and utilizing information technology resources to help people carry out all tasks related to information processing and management [40]. The relationship between the information system and the adoption and implementation of PMS has been confirmed by previous literature. For instance, [41] have found a positive relationship between the MIS and the implementation and use of PMS. Similarly, [42] found that the information system supports the PMS development significantly.

### 3.4 Quality Management Practices

Quality management in the construction sector varies from that of other sectors, as it requires not just the quality of the products but also the overall management activities to meet the standards of the stakeholders [43]. Throughout various countries, the construction industry is regulated by many norms and policies that meet international or local structures. Each country must establish a proper PMS, which meets its quality requirements in the construction industry. Similarly, previous research indicated that quality targets could only be accomplished if they are assessed by standards [43]. In addition, empirical studies suggested that quality management practices such as Total Quality Management (TQM) tend to promote the adoption not only of PMS but of management control systems in general. In addition, in a TQM environment, performance evaluation and PMS are process-driven practices [44]. Furthermore, some previous studies suggested that TQM is one of the factors affecting accounting management activities in UK food and drink companies [16]. Furthermore, according to [45], a survey of 39 organizational units proved the relationship between TQM and performance measures to improve the performance. In addition, [46] stated that the use of TQM is one of the key motives for encouraging BSC adoption. Furthermore, [42] argued that the implementation of quality practices would build a culture of empowerment, customer awareness, continuous improvement and an attitude of fact-based decision-making, all of which could support the adoption of PMS without the need for such a PMS to pre-exist.

Based on the previous arguments, the following theories are developed:

Hypothesis 4 (H4): Leadership positively affects PMS adoption in the construction industry.

Hypothesis 5 (H5): Strategy positively affects PMS adoption in the construction industry.

Hypothesis 6 (H6): Information system positively affects PMS adoption in the construction industry.

Hypothesis 7 (H7): Quality management practices positively affect PMS adoption in the construction industry.

## 4. Theoretical Fundamental

The framework of this study has been developed based on several theoretical perceptions. Institutional theory and contingency theory hold each other toward the desired organization changes to achieve the strategic goal of the organization. Although many researchers claimed that organizations that adopt new systems and technology aimed to gain efficiency and effectiveness, the institutional theory presents another explanation of the motivation for change. To explain, external pressure is the key source of important organizational and strategic changes without which there will not be a notable improvement in organizational performance. Accordingly, political or legitimization is the most important reason behind the transformation of characteristics of any organization [23][24]. Side by side, contingency theory argues that the strategic directions and the change decisions are not constant behavior in all conditions. Instead, the context and the external and internal environment that the organization operates in, play a vital role in choosing the preferable strategy and appropriate managerial practices [47]. Management accounting researchers mostly use contingency perspective as a base of studying the success of using and implementing modern systems such as BSC [46].

## 5. Methodology

This study aims to examine the influence of the external and internal variables (i.e. environmental uncertainty, competition, stakeholder involvement, leadership, strategy, information system, and quality management practices) on the adoption of performance measurement system in construction industry in Yemen. The population of this research is the classes 1, 2, and 3 of construction companies (the largest construction companies according to the Ministry of Public Works and Highways) represented by one person for each firm who is either a manager, an engineer or a consultant. This is because this research is interested in capturing the views of decision-makers and senior staff in the companies.

For the aim of examining the reliability and validity of the questionnaire survey, four academicians and professionals were involved in the validity assessment. In addition, a pilot study was conducted prior to the main data collection where 30 questionnaires were gathered from a sample of the population of this study. Among 260 contractors and companies in construction, which represent classes 1, 2 and 3, the calculated sample size is 155 according to [49]. Stating clearly, given the fact that many researchers reported low response rates in construction research studies [49][50], the sample size was increased by 30 percent, i.e. from 155 to 202. Accordingly, 202 questionnaires were distributed to the companies that were selected based on the processes of the simple random sampling method to give equal chance for all members to participate in this study. Among the collected questionnaires, 104 surveys were found usable and were involved in the analysis representing a 51% response rate. This response rate is adequate according to [51].

Out of 104 respondents, top management members made up the majority of participants (44.2%) whereas middle managers represent 28.8%, and engineers and consultants represent 26.9% of the respondents. It was also noticed that most participants have working experience of more than ten years (49%), followed by 29.9% of participants who have working experience that ranged between 5 and 10 years, and the rest (21.2%) have experience less than five years. Similarly, the participants who have a bachelor's degree make up the predominant group (76.9%) whereas the respondents with a high degree or a diploma represent 17.3% and 5.8% respectively. Moreover, the companies' profiles indicate that most of the participating companies are established more than twenty years ago (42.3%), and the companies between 11 to 20 years old represent 33.7% whereas companies that were established between five and ten years and companies less than five years represent 16.3% and 7.7% respectively. It was also noticed that half of the participating companies have employees ranging from ten to 49 (50%). Besides, 18.3%, 17.3%, and 14.4% are the percentages of companies that have employees between 50 and 249, less than 10, and more than 250 respectively.

Furthermore, this study applied the Partial Least Square Structural Equation Modelling (PLS-SEM) using SmartPLS 0.3 software [52] to examine the relationships between PMS adoption and its drivers in the construction industry in Yemen. Moreover, PLS path modelling is regarded as optimal in this analysis as we strive to predict the endogenous latent variable (i.e. PMS adoption) [53][54]. Besides, it is widely known and chosen as a method best suitable for multivariate analysis in social sciences and psychological studies. Moreover, it is clear that this technique helps in determining the fit between the theory and the data by measuring the relationships between the indicators and the variables (measurement model), as well as between the variables (structural model). In the measurement model (also named as the outer model), the quality criteria of the model were estimated and then the structural model (also called the inner model) was constructed to test the hypotheses of this study [54].

## 6. Analysis and Results

The PLS-SEM path modelling, as a rule, is conducted in two distinct steps. First, the measurement model estimation, which helps to assess the relationship between the items or indicators (manifest variables) and their latent variables, and second, the structural model, which provides an overview of the relationship between the variables, and thus the study hypotheses could be supported or rejected.

### 6.1 Measurement Model Assessment

The measurement model involves assessing the reliability of individual indicators, internal consistency of variables and evaluating discriminant validity [54, 55]. The outer loadings were evaluated for the measures of each construct [54]. According to [56, 57], the rule of thumb determined the threshold of 0.50 for the item's loading. Table 1 indicates the values of the loadings and the other quality metrics of the measurement model.

**Table 1:** PLS measurement model results

Construct	Item	Factor loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
<b>Performance Measurement System adoption (PMS)</b>	PMS1	Deleted	0.850	0.886	0.528
	PMS2	0.669			
	PMS3	Deleted			
	PMS4	0.676			
	PMS5	Deleted			
	PMS6	0.716			
	PMS7	Deleted			
	PMS8	Deleted			
	PMS9	0.759			
	PMS10	0.699			
	PMS11	0.817			
	PMS12	0.741			
	PMS13	Deleted			
<b>Environmental Uncertainty (EU)</b>	EU1	Deleted	0.706	0.815	0.525
	EU2	0.635			
	EU3	Deleted			
	EU4	0.715			
	EU5	0.752			
	EU6	0.789			
<b>Competition (CO)</b>	CO1	0.725	0.708	0.838	0.634
	CO2	0.857			
	CO3	0.800			
<b>Stakeholder Involvement (SIN)</b>	SIN1	0.691	0.744	0.833	0.556
	SIN2	0.757			
	SIN3	0.780			
	SIN4	0.752			
<b>Leadership (LS)</b>	LS1	0.943	0.874	0.908	0.770
	LS2	0.700			
	LS3	0.964			
<b>Strategy (ST)</b>	ST1	Deleted	0.841	0.904	0.758
	ST2	Deleted			
	ST3	0.843			
	ST4	0.898			
	ST5	0.870			
<b>Information System (INS)</b>	INS1	0.934	0.915	0.938	0.793
	INS2	0.916			
	INS3	0.807			
	INS4	Deleted			
	INS5	0.899			
	INS6	Deleted			

**Table 1:** PLS measurement model results (Continued...)

Construct	Item	Factor loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
<b>Quality Management Practices (QM)</b>	QM1	Deleted	0.947	0.959	0.824
	QM2	0.867			
	QM3	Deleted			
	QM4	0.924			
	QM5	0.926			
	QM6	0.899			
	QM7	0.922			

Table 1 illustrates the Cronbach alpha values for the constructs ranging from 0.706 for environmental uncertainty (EU) to 0.947 for quality management practices (QM). So, all the Cronbach alpha values are above 0.7, which is considered acceptable [54]. Similarly, Composite Reliability (CR) also shows acceptable values for all the constructs, which accessed the threshold of 0.7 [54]. However, the least value is 0.815 for EU and the highest value of CR is 0.959 for QM. Accordingly, this model achieved acceptable internal consistency. Convergent validity also was tested to determine if the items represent the constructs or not. Table 1 shows that the values of items loadings and average variance extracted (AVE) achieve the accepted limits which are no less than 0.6 for item loading and more than 0.5 for AVE [54][58]. All the above values are in line with the limits suggested by the academics and indicate the reliability of such study data [54]. The discriminating validity was also determined using the square root of the average variance extracted (AVE) [59]. The squared correlations (in bold) were contrasted with the latent construct correlations. According to [59], the squared correlation of all latent variables is more than the off-diagonal coefficients in the corresponding rows and columns. Table 2 shows that all the correlations along the diagonals are lower than the squared root of AVEs, indicating sufficient discriminating validity.

**Table 2:** Discriminant validity (Fornell-Larcker Criterion)

	<i>CO</i>	<i>EU</i>	<i>INS</i>	<i>LS</i>	<i>PMS</i>	<i>QM</i>	<i>SIN</i>	<i>ST</i>
<i>CO</i>	<b>0.796</b>							
<i>EU</i>	0.395	<b>0.722</b>						
<i>INS</i>	0.413	0.040	<b>0.890</b>					
<i>LS</i>	0.597	0.206	0.769	<b>0.878</b>				
<i>PMS</i>	0.238	0.134	0.484	0.495	<b>0.727</b>			
<i>QM</i>	0.578	0.033	0.776	0.827	0.471	<b>0.908</b>		
<i>SIN</i>	0.378	0.287	0.239	0.362	0.594	0.333	<b>0.746</b>	
<i>ST</i>	0.530	0.124	0.806	0.813	0.386	0.844	0.334	<b>0.871</b>

## 6.2 Structural Model Assessment

The values of path coefficients are measured in the structural model assessment. To do so, 5,000 samples and 104 cases were used in a standard bootstrapping process [54][55]. Figure 1 illustrates the structural model assessment. It presents the results of the t-values and path coefficient of the latent variables relationships.

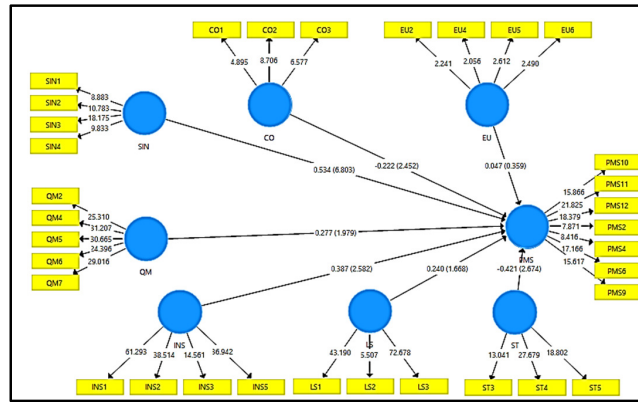


Figure 1. PLS structural model

Table 3 displays the values of the path coefficients of the relationship, the standard error, and the t-value.

Table 3. Structural model results.

	Hypothesis	Path coefficient (β)	Sample Mean (M)	Standard Error	T Statistics ( O/STDEV )	P Values	Decision
EU -> PMS	H1	0.047	0.069	0.130	0.359	0.360	Rejected
CO -> PMS	H2	-0.222	-0.216	0.091	2.452	0.007	Rejected
SIN -> PMS	H3	0.534	0.530	0.079	6.803	0.000	Accepted
LS -> PMS	H4	0.240	0.247	0.144	1.668	0.048	Accepted
ST -> PMS	H5	-0.421	-0.402	0.158	2.674	0.004	Rejected
INS -> PMS	H6	0.387	0.373	0.150	2.582	0.005	Accepted
QM -> PMS	H7	0.277	0.266	0.140	1.979	0.024	Accepted

The table 3 presents the results of hypotheses testing for this study. These results are presented and interpreted below as follows:

In Hypothesis 1, this study proposed that environmental uncertainty has a significant effect on PMS adoption. The results in table 3 indicate that this relationship is not significant ( $p > 0.05$ ). In addition, Hypothesis 2 was rejected because of the negative value of path coefficient ( $\beta$ ), although the relationship is strongly significant with a 1% significance level ( $\beta = -0.222$ ,  $t = 2.452$ ). Additionally, stakeholder involvement has a strong positive relationship with PMS adoption at a 1% significance level whereas the  $\beta$  value is 0.534 and the t value is 6.803 ( $p = 0.000$ ); hence, Hypothesis 3 was supported. Similarly, Hypothesis 4 was accepted as the results indicate a significant effect of the leadership on PMS adoption at a 5% significance level ( $\beta = 0.240$ ,  $t = 1.668$ ,  $p < 0.05$ ). In addition, the strategy has a strong and significant relationship with PMS adoption, as the t value is 2.674 ( $p = 0.004$ ). However, the path coefficient (-0.421) represents negative relationship, so hypothesis 5 was rejected.

Furthermore, hypotheses 6 was accepted as the information system significantly affects the PMS adoption at a 1% significance level ( $\beta = 0.387$ ,  $t = 2.582$ ,  $p < 0.01$ ). Finally, the results found that quality management practices significantly affect PMS adoption at a 5% significance level. The values ( $\beta = 0.277$ ,  $t = 1.979$ ,  $p < 0.05$ ) proved that hypothesis 7 was accepted.

### 6.3 Coefficient of Determination ( $R^2$ )

The determination coefficient ( $R^2$ ) shows how much the exogenous variables are responsible for the variation in the endogenous variable. In this analysis,  $R^2$  indicates 0.545 suggesting that 54.5 percent of the dependent variable (i.e. PMS) are explained by the independent variables of this study (i.e. EU, CO, SIN, LS, ST, INS, and QM). [57] suggested the  $R^2$  values of 0.67, 0.33, and 0.19 to be considered as substantial, moderate, and weak respectively. Consequently,  $R^2$  of the endogenous variable is quite close to substantial effect.

### 6.4 Effect size ( $f^2$ )

The effect size ( $f^2$ ) of any exogenous variable indicates the amount of change in  $R^2$  value when this exogenous variable is omitted from the model [54]. According to [54][60] the effect size is calculated as:

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

According to [60], 0.02, 0.15, and 0.35 are the values of  $f^2$  that indicate small, medium, or large effect size respectively. Based on the results, the effect size ( $f^2$ ) are 0.002 for environmental uncertainty, 0.053 for competition, 0.46 for stakeholder involvement, 0.03 for leadership, 0.08 for strategy, 0.07 for information system, and 0.03 for quality management practices. Thus, the effect sizes for the five exogenous variables, i.e. competition, leadership, strategy, information system, and quality management practices could be considered as small. Whereas stakeholder involvement has a significant effect but environmental uncertainty has almost no effect.

### 6.5 Predictive Relevance ( $Q^2$ )

Predictive relevance ( $Q^2$ ) indicates how relevant are the detected values that constructed the research model and its parameter estimates [57]. The study used blindfolding processes [60][61] to test the predictive validity of the research model. Particularly, this study employed the cross-validated redundancy criterion to assess the predictive relevance ( $Q^2$ ) of the exogenous constructs on the endogenous construct [54][61][62]. Consequently, if  $Q^2$  for any model is more than zero, then this model has predictive relevance and the higher the  $Q^2$  values the higher the predictive relevance [55]. In this study, the  $Q^2$  value is 0.257 for the endogenous latent variable. This indicates the predictive relevance of the model [55][57].

## 7. Discussion

The main objective of this study was to examine the effect of the contextual factors namely environmental uncertainty, competition, stakeholder involvement as external variables, as well as leadership, strategy, information system, and quality management practices as one internal factor on the adoption of the performance measurement system in the construction industry in Yemen.

Contrary to Hypothesis 1 (H1) suggested in this study, the results of the analysis reflected the absence of a significant relationship between environmental uncertainty and PMS adoption. This means that ambiguity, lack of information, lack of clarity in the competition trends and future directions of competitors do not stimulate the construction organizations in Yemen to adopt such a system. This finding is inconsistent with the results of prior related research [46], which found that perceived environmental uncertainty has a positive effect on the extent of BSC usage (as a

performance measurement system) in Vietnam. Finding also inconsistent with the study of [9] that proved the significant relationship between perceived environmental uncertainty and the adoption of performance measurement systems in Danish firms. Therefore, it requires further investigation of the issue.

Similarly, Hypothesis 2 (H2), which stated that competition would have a significant positive effect on PMS adoption, was rejected as findings revealed that there is a significant but negative relationship between these two variables. The implication of this is that the less competition in the market among construction companies, the greater their motivation to adopt PMS. This finding is inconsistent with the findings of [46] who found that the intensity of competition has a significant effect on the extent of BSC usage. Besides, this finding is conflicting with [39], which concluded that the degree of competition has a significant effect on the uses of a multiple performance measurement system.

According to Hypothesis 3 (H3), the results showed a statistically strong significant effect of stakeholder involvement on PMS adoption, which means that the more stakeholder involvement, the higher chance of the company to adopt PMS. This result is consistent with past studies that showed a strong link between stakeholder involvement, interest and PMS [17].

Concerning Hypothesis 4 (H4), this study proposed that leadership has a significant positive effect on PMS adoption. As hypothesized, the results of the analysis revealed that there is a significant relationship between both variables. This finding indicates the important role of management in facilitating and supporting the adoption of PMS as it was concluded by prior studies [4][42].

Additionally, as predicted in Hypothesis 5 (H5), the strategy showed a significant, but a negative relationship with PMS adoption. The implication of this is that, in construction companies, strategy could have a strong but negative effect on the adoption of PMS. This may indicate some issues related to either the strategic choice of the companies, the effectiveness and efficiency of the performance measurement process, the problems related to the selection of proper measures, etc. However, the finding of this study is inconsistent with the previous studies [36][37][46], which calls for further studies in this regard.

Furthermore, Hypothesis 6 (H6) was supported in this study as it found that the information system has a strong positive impact on the adoption of PMS. This finding is in line with previous studies that confirmed the important role that information systems could play in promoting the adoption of any modern management control system such as PMS [4][42].

Over again, Hypothesis 7 (H7), which stated that quality management practices could have a significant positive effect on PMS adoption, was found to be accepted as results revealed that there is a significant positive relationship between these two variables. The implication of this is that the more quality management practices a construction company integrates into its operations and strategy, the greater is the possibility of adopting PMS. This finding is consistent with [42] (2013) who asserted that the quality management practices in an organization, lead to building a culture that helps in adopting PMS.

## 8. Conclusions

Adopting the performance measurement system in the construction industry has become essential as an effective mean of superior performance that organizations seek. This study aims to introduce a better understanding of the determinants of performance measurement system adoption in the construction industry in Yemen. This paper also examined the relationships between PMS adoption and the external factors, i.e. EU, CO, and SIN, and also the relationship between PMS and the internal factors presented in LS, ST, INS, and QM. Furthermore, the conceptual framework that the hypotheses are based on integrates contingency and institutional theories to provide a comprehensive understanding of the effect of selected factors. Generally, the outcome of this study has important theoretical and practical implications. The research was mainly able to provide a theoretical interpretation by presenting additional empirical evidence within the contingency and institutional concepts. For example, this study opposed previous studies that confirmed the impact of EU on the adoption of management control systems such as PMS. Besides, the negative effects of CO and ST

prove the view of contingency theory that emphasizes taking into account the special circumstances when applying any new system in a company. In addition, the strongly significant effect of SIN supports the perspective of the institutional theory about the importance of external intervention to bring about change. From a practical point of view, this study attracts the attention of decision-makers and all stakeholders to the importance of the external pressure on construction companies in Yemen to adopt such systems that help improve the performance of construction companies and the construction industry in general. This study emphasizes dealing with this issue from different angles in the future, particularly in the stage of building the theoretical framework for a study. The integration of more theories could be fruitful in this regard.

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