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Does management accounting mediate the relationship between cost system design and performance?

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ABSTRACT

This study aimed at investigating the mediating effect of management accounting practices (MAPs) upon the association between cost system design (CSD) and performance. Covariance-Based Structural Equation Model methodology was applied to investigate the complex relationship between the latent constructs. The findings indicated that cost system design alone does not impact firm performance. However, it affects performance via MAPs. We projected that MAPs play a full mediating role between CSD and performance. Thus, this study indicates that incurring high costs for the establishment of a functional cost system might be justifiable, on condition that the firm will utilize the obtained cost data through various decision-making tools; otherwise there is no point in bearing the cost of building such a system.

1. Introduction

Increasing costs, intensifying competition, and declining profit margins are encouraging companies to establish a robust and comprehensive cost system and to implement sophisticated MAPs that assist managerial decision-making. Economic crises also increase the importance and the usage of sophisticated MAPs (Pavlatos & Kostakis, 2015). In this new economic environment, firms are unable to survive by using traditional cost systems that simply calculate the unit cost of products or services; on the contrary, they have to develop a modern cost system with critical attributes that plays an important role in the functioning of management. In doing so, they assume that they will be able to overcome their competitors, and continue as a going concern.

Kaplan and Cooper (1998) asserted that cost systems perform three functions for firms: the valuation of the inventory and the calculation of the cost of goods sold, estimating the costs of activities, products, services, and customers, and providing economic feedback to managers. The first function meets the needs of the external decision-makers by providing data for the periodic balance sheets and income statements. For this function, detailed cost information is not necessary because the aggregate amounts are sufficient. However, the second and third functions meet the needs of the internal decision-makers, in particular, managers, in order to create improved efficiency of operations and, ultimately, the overall profitability of the company.

Management accounting is part of an organization's management control systems (Frezatti, Aguiar, Guerreiro, & Gouvea, 2011), and its role in organizations has evolved from simple bookkeeping to a greater involvement in decision making (Bai & Krishnan, 2012; Walker, Fleischman, & Johnson, 2012). Initially, it was used as a tool for tracking the cost of manufacturing inputs as well as cost calculation and financial control. However, the changing business environment has placed management accounting into a more strategic position in organizations, forcing them to have more sophisticated management accounting systems that enable a more accurate costing (i.e. activity-based costing), a more comprehensive performance evaluation (i.e. balanced scorecard), and value-chain analysis, as well as analysis of customers and competitors. All these sophisticated MAPs require a functional cost system which has certain attributes such as detail, classification, accuracy, variance, and frequency as classified by Pavlatos and Paggios (2009).

Several prior studies have investigated the factors impacting cost system design (CSD) in firms (Abernathy, Lillis, Brownell, & Carter, 2001; Al-Omiri & Drury, 2007; Pavlatos & Paggios, 2009); however, the direct impact of CSD on performance has rarely been investigated (Lee et al., 2010), so far the evidence is inconclusive (Henri, Boiral, & Roy, 2016; Lee, 2003; Pizzini, 2006). This link is significant from the owners' and managers' perspectives, since establishing a comprehensive cost system consumes resources which incurs costs. Thus, in return, managers and owners expect a benefit which is measured by incremental performance. Numerous other studies have focused on the performance effects of management accounting practices (MAPs). In a recent study, Mohamed and Jones (2014) proposed a model which incorporates strategic management accounting tools to predict profitability in Egyptian information and communications technology; indeed they proved this relationship. Another Egyptian study proved that the management accounting system positively affects managerial

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performance in the healthcare industry (Hammad, Jusoh, & Ghozali, 2013). In German hospitals, Lachmann, Knauer, and Trapp (2013) found that the superiority of organizational performance does not result from the mere application of strategic management accounting; rather, it requires an appropriate match of the organizational characteristics with the configuration of strategic MAPs. Duh, Xiao, and Chow (2009) provided empirical evidence about the positive impact of MAPs upon the performance of Chinese firms. Macinati and Pessina (2014) indicated that there is a positive relationship between management accounting use and the financial performance of Italian healthcare organizations. Soobaroyen and Poorundersing (2008) found that four dimensions of the management accounting system (scope, timeliness, aggregation, and integration) positively influence managerial performance.

This study distinguishes itself from prior ones, in particular, by exploring the mediating effect of MAPs between cost system design and firm performance as well as the performance effect of CSD and MAPs. Tse (2011) and Michael (2011) point out the importance of the use of cost information to improve individuals' decision performance. We normally expect an increase in organizational performance as the result of improvement in an individual's performance. In addition, Hutchinson (2010) draws attention to the usage of an appropriate cost accounting system designed to improve performance by the simulation approach, arguing that better decisions are based on accurate cost measurements. Furthermore, some prior studies focus on strategically changing the roles of management accountants. (Goretzki, Strauss, & Weber, 2013; Järvenpää, 2007). Thus, meeting the expectations of organizations requires management accountants to utilize sophisticated methods which require extensive, accurate, and timely cost data. The investigation of this subject is important, since firms continually seek ways to improve their performance. Thus, this study draws the attention of managers to the benefits of establishing a functional cost system and utilization of the cost data provided through this system using MAPs to improve performance. Although aggregate cost data and traditional MAPs are still used by firms, in particular small and medium-sized ones, they are insufficient for today's competitive environment (Lavia López & Hiebl, 2014). Thus, more sophisticated cost and management accounting systems are vital for the successful management of business organizations. Prior studies also point out the scarcity of studies on management accounting systems in developing countries; the present study therefore aims at filling the existing gap in this respect (Lavia López & Hiebl, 2014). Unlike prior studies on cost systems carried out in specific industries such as hospitals (Pizzini, 2006) and hotels (Pavlatos & Paggios, 2009), this study is based upon a sample of diverse industries. Finally, this study utilizes structural equation modeling, which has not been used extensively in past management accounting studies (Cadez & Guilding, 2008). Finally, designing a robust cost system, managing costs, and improving performance are vital for Turkish firms, in particular by intensifying the competitive environment due to the entrances of new local and foreign businesses in the marketplace. Thus, it is anticipated that this paper will help Turkish firms remain competitive.

The elaboration of this subject is important to the country for the following reason: although large corporations are well aware of the need for a functional cost system and the utilization of management accounting tools, it is not so for small and medium-sized enterprises. Their accounting function, like other business functions, is not well developed since its basic focus is on financial accounting, in particular, tax accounting. Thus, their attention should be directed towards the topic. In addition, the partners/managers of these small and medium-sized enterprises are generally family members; they therefore consider accounting information to be both confidential and commercially sensitive. This plays negative role in the development of accounting function including cost and management accounting. This demonstrates a need for studies which will help to raise awareness of cost and managerial accounting among partners/managers and improve the management of their firms.

Finally, although there some prior studies regarding cost and management accounting practices of Turkish enterprises, they are mostly descriptive and exploratory (Uyar, 2009, 2010; Uyar & Bilgin, 2011; Yalcin, 2012). Further studies are needed to investigate the interrelationship between cost system and management accounting, and their effect on firm performance. Thus this study aims at filling this gap.

2. Literature review and hypotheses

2.1. Five attributes of cost system design

This study adopted the critical attributes of CSD from Pavlatos and Paggios (2009) and Pizzini (2006). Pavlatos and Paggios (2009, p. 264) defined cost system functionality as "the quality of cost accounting information which is provided by a cost system", and they provided the following five critical attributes:

- *Detail*: The cost system supplies detailed cost data about cost objects.
- *Variance*: The cost system calculates efficiency and price variances.
- *Accuracy*: The cost system provides the most accurate cost information possible.
- *Frequency*: The cost system supplies reports to managers systematically.
- *Classification*: The cost system disaggregates costs according to behaviors such as variable/fixed, direct/indirect, product/period.

Previously, some studies have investigated the factors driving CSD. It is assumed that the complexity of the production process affects the choice of costing system; firms which have complex production systems are likely to have more a complex costing system (Malmi, 1999). Pavlatos and Paggios (2009) determined that CSD is shaped through several contingent factors. On the other hand, Pizzini (2006) investigated the performance effect of CSD, finding that the managers of US hospitals perceive cost data to be more useful and relevant if the cost system provides more detailed, better classified cost data on a more frequent basis. She found that the more functional cost systems help managers improve some aspects of hospital operations.

2.2. Impact of CSD on MAPs

Pizzini (2006) indicated that managers find cost data useful and relevant if they are detailed, well classified, and provided frequently. This might be explained by the fact that sophisticated MAPs used by managers require updating through a sophisticated cost system providing detailed, classified, and timely data regarding products, services, activities, customers, and units. In this case, a cost system will act as a catalyst for the utilization of MAPs. For example, Al-Omiri and Drury (2007) found that cost system sophistication is positively associated with the extensive use of innovative MAPs. Thus, we formulate the following hypothesis:

H1. CSD has a positive impact on the utilization of MAPs.

2.3. Impact of MAPs on performance

The ultimate purpose for adopting business practices is to contribute to the overall performance of the organization. Thus, the purpose of various MAPs is to improve subunit and overall performance through financial control, planning and controlling of operations, using business resources economically, and the creation of value. Supporting this assertion, Macinati and Pessina (2014) argued that the ultimate purpose of MAPs is to increase organizational performance. Gerdin (2005) also argued that an appropriate combination of frequency as well as the amount of management accounting information use may enhance the performance of the firms. Several prior studies provided empirical evidence supporting the association between MAPs adoption and performance (Agbejule, 2005; Cardinaels, Roodhooft, & Warlop, 2004; Davila & Foster, 2005; Lachmann et al., 2013; Macinati & Pessina, 2014; Mia, 2000; Xiao, Duh, & Chow, 2011). Thus, we formulate the following hypothesis:

H2. MAPs have a positive impact on firm performance.

2.4. Impact of CSD on performance

Prior studies have indicated that CSD alone, in all likelihood, without interaction with the other applications in the business organizations, does not to contribute to performance at all since the cost system provides raw data for decision-making tools. For example, Pizzini (2006) investigated the association between four attributes of the cost system (i.e. detail, classification, frequency, and variance) with the financial performance in US hospitals, finding that only the attribute of detail was significantly associated with financial performance. However, Maiga, Nilsson, and Jacobs (2014) proved that the cost control system improves performance significantly when interacting with information technology. Cagwin and Bouwman (2002) found that activity-based costing, which provides superior information compared to traditional costing systems, improved financial performance when used with some other strategic initiatives concurrently in specific environmental conditions. Thus, we formulate the following hypothesis:

H3. CSD does not have a significant impact on firm performance directly.

2.5. Mediating role of MAPs in CSD's performance effect

In the third hypothesis, a non-significant relationship between CSD and performance was assumed. Various researchers have pointed out that there is limited or conflicting evidence for the link between CSD and performance (Lee, 2003; Pizzini, 2006). However, the cost system provides vital inputs for MAPs, which facilitates managerial decision making (Chong & Eggleton, 2003). Henri et al. (2016) argued that the cost data produced by sophisticated cost systems improves managerial decision making, hence leading to higher firm market performance. Because, the raw cost data is converted to useful information by MAPs for the use of managers in making strategic decisions. Therefore, we assume a mediating impact from MAPs for the association between CSD and performance. This mediating role has never been investigated in prior studies. Banker, Bardhan, and Chen (2008) found that world-class manufacturing techniques mediate the positive influence of activity-based costing on plant performance; however, ABC does not have a significant direct impact on plant performance. In the construct of this study, MAPs are measured by four dimensions: financial control, management planning and control, reduction of waste in business resources, and value creation through the effective use of resources. We assume that all of these dimensions must be supported by a well-designed cost system, eventually leading to enhanced firm performance. Thus, we formulate the following hypothesis:

H4. MAPs play a mediating role between CSD and performance.

3. Research methodology

Covariance-Based Structural Equation Model (CB-SEM) methodology was used to investigate the complex relationship between the latent constructs shown in Fig. 1. In addition to CB-SEM, partial least squares-SEM (PLS-SEM) can be used. PLS-SEM is recommended when the sample size is small and the theoretical model is in the early stage. On the contrary, CB-SEM requires a large sample, with the recommended sample size being five times the number of indicators included in the original model. There are 31 indicators in this model and the sample size is 553. Accordingly, CB-SEM is an appropriate method for this research model.

To measure the proposed model, three constructs (i.e. cost system design (CSD), MAPs, performance) were utilized. To measure CSD, five items were utilized as adapted from Pizzini (2006) and Pavlatos and Paggios (2009), while to measure the performance, a 5-item non-financial performance scale was modified from Deshpande, Farley, and Webster (1993), Keskin (2005), King, Clarkson, and Wallace (2010). The MAPs construct was measured under four sub dimensions of MAPs (Effective use of resources (6 items), Financial control (4 items), Planning and control (7 items), and Reduction of waste in business resources (5 items)). This MAPs construct was adapted from Abdel-Kader and Luther (2008) on the basis of four sophistication levels of MAPs as derived from IFAC (International Federation of Accountants)'s statement titled "International Federation of Accountants" (IFAC, 1998).

3.1. Sample

The sample for this study is based upon firms randomly selected from the databases of the Chambers of Commerce and Industry. The firms are located in the region of Marmara, Turkey, the hub of Turkish business organizations (Zeybek & Kaynak, 2008). From the list provided by the database, 1500 non-financial firms were contacted, out of which 575 agreed to participate in the survey (i.e. response rate, 38%). Financial firms were excluded from the study since there are significance differences in cost and management accounting practices between financial and nonfinancial firms. The data was prepared for initial

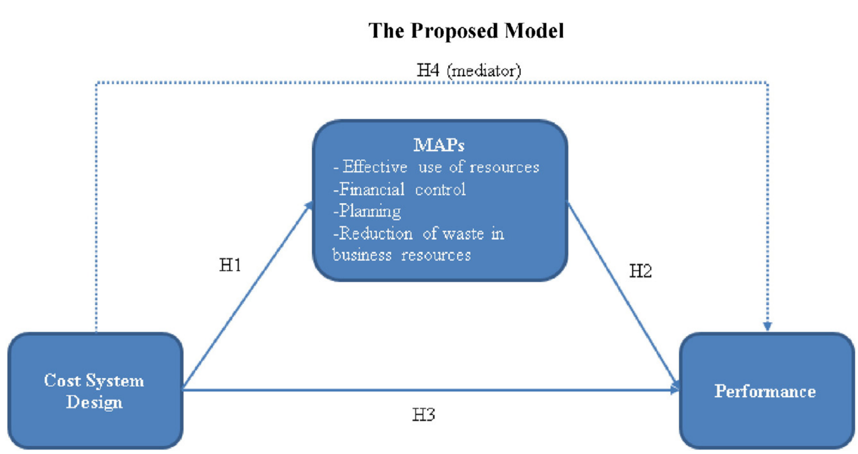

Fig. 1. The proposed model.

processing as follows. Initially missing data analysis was applied. As a result, ten cases were eliminated, since the respondents did not answer a large portion of the survey. According to Little's MCAR test result (Chi-square: 46.07; d.f.: 60; p-value: 0.907), the values of five cases were missing in a random way. Those missing values were imputed using median replacement since it was Likert-type data (Lynch & Jarvis, 2008). The univariate and the multivariate normality (Table 1) using Mardia's test (Mardia, 1985) results showed that the data was nonnormal. In addition, Z-score (greater than 3.29) as well as Mahalanobis D^2 values were calculated in order to detect the univariate and multivariate outliers. The detected outlier cases with a probability associated with a Mahalanobis D^2 value of 0.001 or less, were also eliminated. As a result of these preliminary processing steps, 553 data remained for analysis.

The linearity between latent variables was also assessed using OLS regression analysis between each independent variable and the dependent variable. The relationship was considered to be sufficiently linear since the significant value was less than 0.05; visually inspecting the factor score estimates (Bauer, Baldasaro, & Gottfredson, 2012) in which the generated factor score estimates were plotted to determine the linearity. Both approaches demonstrated no issue of linearity.

The survey questionnaire was distributed to high-ranking administrators who were board members, partners/owners, general managers, managers, controllers, treasurers, and budget managers. Table 2 shows the frequencies and percentages concerning the positions of the respondents' and the industry category. The majority of the participants were Controllers, General Managers and Managers. According to the descriptive statistics, the highest percentage of the participant firms operated in the fields of textiles, household durables, food, and metals.

Table 2
Distribution of respondents.

	Frequency	Percent
Respondent		
Controller	225	41
General manager	119	22
Manager	103	19
Board member	34	6
Partner/owner	26	5
Treasurer	17	3
Budget manager	16	3
Other	13	2
Total	553	100
Industry		
Textiles, apparel & luxury goods	170	31
Food, beverages & tobacco	58	10
Metals & mining	57	10
Construction materials	8	1
Machinery	35	6
Automobiles & auto components	16	3
Chemicals	62	11
Construction & engineering	34	6
Household durables	70	3
Paper products & packaging	17	3
Commercial services & supplies	8	1
Other	18	3
Total	553	100

4. Results

4.1. Exploratory Factor Analysis (EFA)

EFA was employed to uncover the underlying structure of the given large set of items, as well as to determine the underlying relationships between measured variables. It is considered to be necessary for the robustness of the constructs such as MAPs, Cost System and Performance as well as for preparing the variables to be used for SEM. This enabled us to find the problematic variables easily. The adequacy of the data was checked before the EFA analysis by using the Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO index) as well as Bartlett's Test of Sphericity. The results indicated that the KMO index (0.84) was well above the threshold value of 0.7, and that Bartlett's Test of Sphericity ($\chi^2 = 2486.01$; d.f. = 66, $p < 0.001$) was significant.

Discriminant validity is satisfied if the items have a strong relationship with their own factor, rather than to another factor. The results indicated that discriminant validity was satisfied, since the factor loading score of an item under the associated factor was significantly higher than the other values, and the difference was more than 0.20 in the row level.

Table 1
Descriptive statistics, univariate and multivariate normality test results.

Variable	Mean	Std. dev.	Skewness	Kurtosis	Pr (Skewness)	Pr (Kurtosis)	Joint Prob > χ^2
CSD1	0.808	0.390	−1.580	3.516	0.000	0.029	0.000
CSD2	0.884	0.318	−2.418	6.868	0.000	0.000	0.000
CSD3	0.878	0.322	−2.352	6.572	0.000	0.000	0.000
MAP1	3.548	0.925	−0.614	2.973	0.000	0.984	0.000
MAP2	3.715	0.785	−0.695	3.239	0.000	0.230	0.000
MAP3	3.486	0.943	−0.514	2.747	0.000	0.207	0.000
MAP4	3.716	0.894	−0.631	2.882	0.000	0.644	0.000
PRF1	3.923	1.082	−1.090	3.612	0.000	0.013	0.000
PRF2	3.701	1.084	−0.665	2.814	0.000	0.396	0.000
PRF3	3.825	1.048	−0.692	2.850	0.000	0.523	0.000
PRF4	3.339	1.105	−0.250	2.326	0.017	0.000	0.000
PRF5	4.015	1.067	−0.953	3.137	0.000	0.435	0.000

Test for multivariate normality − Mardia Skewness: 27.702; $\chi^2(364)$: 2569.190; Prob > χ^2: 0.0000. Mardia Kurtosis: 213.143; $\chi^2(1)$: 838.507; Prob > χ^2: 0.0000.

The R-matrix (correlation matrix) as well as the VIF (Variance Inflation Factor) were assessed for determining multicollinearity. The determinant of the matrix was 0.011 which was greater than the recommended value of 0.0001 (Field, 2009). In addition, the VIF value was 1.54, which is less than the recommended value of 10 (Hair, Anderson, Tatham, & Black, 2010). The results indicated that no issue of multicollinearity exists. Moreover, the Barlett's measure test was significant ($p < 0.001$), rejecting the null hypothesis that the original correlation matrix is an identity matrix. We also checked the reproduced correlations matrix which provides residuals (differences between the matrix based on the model and the matrix based on the observed data). We expect these residuals to be small, perhaps less than .05. In our data, 19 residuals (28%) were greater than 0.05, which is under 50% of the recommended proportion (Field, 2009).

For factor extraction, EFA was conducted using Principal Component Analysis with variamax orthogonal rotation for 14 items in order to determine the underlying dimensions of the given questions. An eigenvalue of 1 was selected for the cut-off point in order to determine the factors, and two items from the cost system was removed from the analysis since it produced a very low level of factor loading. EFA results, including cross factor loadings, average variance extracted values, and composite reliability scores as well as Cronbach's Alpha values are illustrated in Table 3. There were three factors: cost system, performance, and MAPs.

It is recommended to check factor loadings, discriminant validity, convergent validity, and face validity as well as reliability. Convergent validity is satisfied when the variables within a single factor are highly correlated. The sufficient factor loading value for a sample size of 350 is 0.30 (Hair et. al., 2010). It was clear from the EFA results that convergent validity was met, since the factor loadings were well above the threshold value of 0.30, given that the sample size was 553. Discriminant validity is satisfied if the items have a strong relationship with their own factor, rather than with another factor. The results indicated that discriminant validity was satisfied, since the factor loading score of an item under the associated factor was significantly higher than the other values, and the difference was higher than 0.20 in row level.

Table 3
Factor loadings.

ITEMS	MAP	PRF	CSD
MPLN	**0.897**	0.159	0.112
MRW	**0.854**	0.138	0.119
MFC	**0.832**	0.181	0.151
MEUR	**0.827**	0.192	0.124
PRF1	0.048	**0.832**	0.081
PRF2	0.136	**0.795**	0.099
PRF3	0.074	**0.739**	−0.018
PRF4	0.229	**0.633**	−0.021
PRF5	0.196	**0.615**	0.154
CSD1	0.039	0.055	**0.714**
CSD2	0.071	0.097	**0.702**
CSD3	0.230	0.012	**0.502**
Eigen value	3.086	2.776	1.361
Variance (%)	25.720	23.132	11.344
Cumulative variance (%)	25.720	48.852	60.196
Average variance extracted	0.629	0.548	0.502
Composite reliability	0.911	0.858	0.751
Cronbach's α	0.907	0.794	0.507

CSD: Cost system design; PRF: Performance; MAP: Management Account Practice.

Face validity is determined if the extracted factors make sense. There was no issue about face validity, since the extracted factors were consistent with the names; as well, they made sense. Finally, reliability was assessed using Cronbach's Alpha. The values were above the recommended value of 0.7 except for the value of cost system. Even when the reliability score of the cost system was below the recommended value, the composite reliability (0.751) value as well as the AVE (0.502) scores were above the threshold values of 0.7 and 0.5 respectively. Therefore, the reliability of the constructs was satisfied.

The common method variance (CMV) issue relates to the common method used for the research data collection. CMV was addressed using the Harman one-factor test Podsakoff and Organ (1986), which was first used to evaluate the potential Common Method Bias (CMB) by entering all constructs into an unrotated principal components analysis. The results indicated that the obtained cumulative variance was 34.2%, showing that not a single factor accounted for more than 50% of the variance.

4.2. Confirmatory factor analysis (CFA)

In addition to EFA, confirmatory factor analysis (CFA) was necessary in order to investigate the extracted factor structure of the dataset by confirming it, as well as to assess the fit of the research model. Model fit is recognized by how well the proposed model accounts for the correlations between variables. CFA was performed using IBM SPSS AMOS 21. A second-order factor model was used for the measurement model as well as the structural model, since MAPs has four sub-dimensions (Effective Use of Resources; Financial Control; Planning and control; and Reduction of Waste in Business Resources). The metrics for CFA, reliability, convergent validity, and discriminant validity as well as the Pearson correlation coefficients are shown in Table 4. Convergent validity, discriminant validity, and reliability are necessary for CFA. Composite Reliability (CR), Average Variance Extracted (AVE), Maximum Shared Variance (MSV), and Average Shared Variance (ASV) were assessed for this purpose. In order to determine reliability, CR should be greater than 0.7 (Hair et al., 2010). There was no concern about the reliability of the constructs, since the CR values ranged between 0.75 (cost system) and 0.91 (performance). AVE values with greater than 0.5 show the convergent validity (Hair et al., 2010); the values were above 0.5 for each latent variable, therefore convergent validity was not an issue. Finally, discriminant validity is satisfied if AVE values are greater than MSV and ASV and the square root of AVE is greater than inter-construct correlations (Hair et al., 2010). According to the results, the values of AVE were much larger than the values of MSV and ASV. Also, the square root of AVE scores was greater than the inter-construct correlation coefficients. Thus, the results indicated that there was no problem with the discriminant validity. In conclusion, the reliability and validity values showed that the measures were unidimensional.

The goodness of fit was calculated by checking various measures such as the chi-square/d.f., the comparative fit index (CFI), the goodness of fit index (GFI), the adjusted goodness of fit index (AGFI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA). Table 4 illustrates the fit measures for CFA. According to Hu and Bentler (1999), the recommended threshold values for the fit measures are chi-square/d.f. < 3, CFI > 0.90, GFI > 0.95 (0.90 is permissible), AGFI > 0.80, SRMR < 0.09, RMSEA < 0.05, and PCLOSE > 0.05. The results from the fit measures showed that chi-square/df was 2.41, CFI was 0.93, TLI was 0.92, IFI was 0.93, GFI was 0.90, AGFI was 0.87, SRMR was 0.04, RMSEA was 0.05, and PCLOSE was 0.49. In conclusion, the fit indices indicated that there was no issue related to model fit. Therefore, the investigation of the structural model could proceed, in order to determine the hypothesized relationships among the latent variables.

4.3. Structural Equation Model (SEM)

The covariance-based structural equation modeling method was employed. Due to the severe univariate and the multivariate nonnormality of the data, SEM with a robust maximum likelihood estimator using the Sattorra–Bentler scaled chi-squared test (Satorra & Bentler, 1994) was applied to determine the hypothesized relationship and to validate the proposed model. The SEM model's results are provided in Table 5, which includes the coefficient values between the constructs and the critical ratio values, as well as the goodness of fit

Table 4
Reliability and validity analysis of CFA.

Variables	Mean	Std. dev.	CR	MSV	ASV	AVE	CSD	MAP	PRF
Cost system design (CSD)	0.716	0.114	0.752	0.124	0.077	0.502	0.709**		
MAP	3.539	0.725	0.935	0.141	0.133	0.782	0.353	0.884**	
Performance (PRF)	2.660	0.544	0.858	0.141	0.086	0.548	0.175	0.376	0.740**
Chi-square df:395) = 951.16									
Chi-square/df = 2.41									
CFI (comparative fit index) = 0.93									
TLI (Tucker–Lewis Index) = 0.92									
IFI (incremental fit index) = 0.93									
GFI (goodness of fit index) = 0.90									
AGFI (adjusted goodness of fit index) = 0.87									
SRMR (standardized root mean square residual) = 0.04									
RMSEA (root mean square error of approximation) = 0.05									
PCLOSE = 0.49									

Bold numbers in the diagonal of the correlation matrix are the square root of AVE values.
** $p < 0.01$.

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Table 5
Structural equation and measurement model and modeling Results.

Hypothesized relationships		Coefficients	Z-stat.	Result
H1	CSD → MAPs	2.690***	4.01	Supported
H2	MAPs → Performance	0.388***	4.13	Supported
H3	CSD → Performance	0.627	1.10	Supported

Variable		Coefficients	Z-stat.
MAP	MAP1	1.000	(Constrained)
	MAP2	0.827	17.09
	MAP3	0.899	11.89
	MAP4	0.961	15.43
CSD	CSD1	1.000	(Constrained)
	CSD2	0.692	3.75
	CSD3	0.783	4.06
PRF	PRF1	1.000	(Constrained)
	PRF2	0.892	7.34
	PRF3	0.734	6.49
	PRF4	0.978	5.93
	PRF5	0.694	6.14
LR Test of model vs. Saturated: $\chi^2(39) = 52{,}13$, Prob > $\chi^2 = 0.08$			
LR Test of model vs. Saturated: $\chi^2(39) = 52{,}13$, Prob > $\chi^2 = 0.08$			
Satorra–Bentler scaled test: $\chi^2(39) = 41.73$, Prob > $\chi^2 = 0.35$			
Satorra–Bentler RMSEA = 0.01			
PCLOSE = 0.997			
AIC (Akaike's Information Criterion) = 12,765.22			
BUC (Bayesian Information Criterion) = 12,985.30			
Baseline Comparison: CFI (comparative fit index) = 0.995			
TLI (Tucker–Lewis Index) = 0.991			
Satorra–Bentler: CFI (comparative fit index) = 0.999			
TLI (Tucker–Lewis Index) = 0.998			
SRMR (Standardized Root Mean Squared Residual) = 0.019			
Coefficient of Determination = 0.504			

*** $p < 0.001$

Table 6
Effects between cost system design, MAPs and performance.

Effects	Estimates	S.E.	Lower Bounds (BC)	Upper Bounds (BC)	Two-Tailed Significance (BC)
Panel A: Direct effect between cost system design and performance					
Direct Effects	1.104	0.180	0.776	1.489	0.0001
Panel B: Indirect effect from cost system design to performance via MAPs					
Indirect Effects	1.095	0.139	0.85	1.397	0.001
Panel C: Direct effect from cost system design to performance					
Direct Effect	0.008	0.185	−0.342	0.389	0.973

BC: Bias-corrected percentile method.
S.E.: Bootstrap standard error.

statistics values. It was clear that there was no problem in terms of model fit since the fit indices satisfied the recommended threshold values.

Firstly, there is a significant positive association between the cost system design and MAPs ($\beta = 2.69$; $Z = 4.01$, $p < 0.001$). Secondly, MAPs have a positive and highly significant impact on performance ($\beta = 0.39$; $Z = 4.13$, $p < 0.001$). Finally, there is no statistically significant direct relationship between CSD and performance. The SEM results indicated that H1, H2 and H3 were supported.

4.4. Mediating analysis using bootstrapping

Mediation is assessed when the effect of the independent variable on the dependent variable is reduced after the mediator is included into the model while the mediator has a substantial effect on the dependent variable (Baron & Kenny, 1986). Mediation analysis through the bootstrapping method, with 5000 bootstrap samples, was used to determine the mediating role of MAPs between the CSD and performance. The maximum likelihood (ML) bootstrap with a 95% bias corrected (BC) confidence interval level was selected. The bootstrapping method provided the total indirect effect as well as the specific indirect effects of the independent variable on the dependent variable smoothly. This was achieved by mediators through estimating standard errors, confidence intervals, and the biases, while reducing the likelihood of parameter bias due to the omitted variables (Efron, 1979). Initially the relationship between the CSD and performance without the mediator (MAPs) was tested to determine if there was a significant direct effect between them (Fig. 2). The results indicated that the direct effect between CSD and performance was significant at a 5% significance level (Panel A of Table 6). It is important to have a significant direct effect that can be mediated by MAPs.

In the second phase of the analysis, MAPs was added (Fig. 3). The indirect effect from the CSD through MAPs to performance was significant at a 5% significance level (Panel B of Table 6). This showed a mediation between the CSD and performance. In order to determine whether this mediation was full or partial, the results of the direct effect between the CSD and performance were investigated. According to Panel C of Table 6, the direct relationship was not statistically significant at a 5% significance level, which indicates that the relationship between the CSD and performance was completely mediated by MAPs. Therefore, there was a full mediation. The mediation analysis results showed that H4 is supported.

5. Conclusions

This study aimed at investigating the mediating effect of MAPs on the relationship between CSD and performance. The topic is particularly relevant in these times of increasing competition in the marketplace and tightening profit margins. In such times, firms must utilize sophisticated decision-making tools to enhance their performance. However, utilization of those tools requires extensive cost data. Thus, we examined whether CSD contributes to firm performance via MAPs. The findings indicated that CSD alone does not impact firm performance. However, it does affect performance via MAPs. We proved that MAPs play a full mediating role between CSD and performance. Moreover, it was found that CSD has positive impact on the utilization of MAPs, and MAPs contribute to performance positively.

The study has important implications for firms. Designing a functional cost system does not come for free. It requires the integration of various units in the business, such as accounting, information technology, human resources, and production. Collaboration by these departments can establish and develop a robust and functional system over time, considering the changing needs of organization. Therefore,

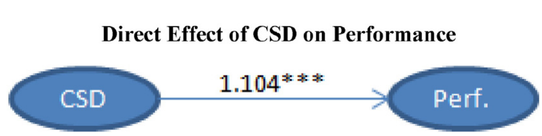

Fig. 2. Direct effect of CSD on performance.

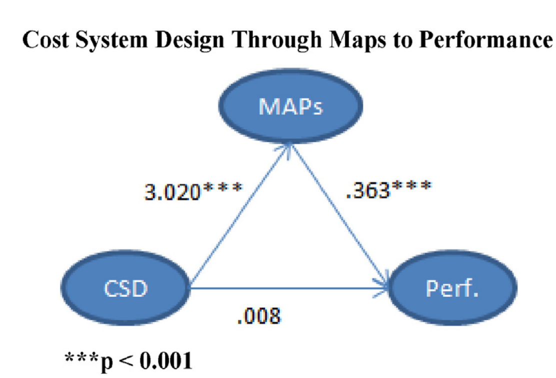

Fig. 3. Cost system design through maps to performance ***p < 0.001.

while undertaking such an initiative, managers should carefully weigh the costs of establishing and maintaining an extensive cost system against the benefits it can bring. Thus, this study indicated that incurring high costs for the establishment of a functional cost system could be justified, on the understanding that the firm will utilize the cost data obtained from that system through the various decision-making tools; otherwise, there is no point to bearing the cost of building such a system. In other words, utilization of MAPs justifies the establishment of an extensive cost system, and bearing its costs.

The study has some limitations regarding sample and performance data. The sample included non-financial firms only. Another limitation was that the performance measurement was based upon the respondents' evaluations rather than real financial data extracted from financial reports, since non-publicly traded firms are unwilling to provide their financial data to the world outside.

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