

The Impact of Supply Chain and Business Process Managements on Firm Performance: The Mediating Effect of Competitive Advantage: Part II Testing Hypotheses

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Abstract

In today's fierce competition situation in business world, achieving business competence is an essential part of firms' survival and sustainability. This paper discusses how supply chain and business process managements are related in building firms' competitive advantage and for better performance outcomes. In Chang and Park (2017), Supply chain and business process management practice antecedents were identified based on studying prior literature. They presented an integrated framework of SCM and BPM and constructed 6 research hypotheses. In this paper, we tested them using a sample of 74 Tanzanian firms. Partial least square based structural equation modeling (PLS-SEM) method was used to test the hypotheses. The empirical test results indicate that both SCM and BPM are essential practices for the improvement of firms' overall performance measures. Firms' competitive advantage was found to be a significant mediator between these business practices and organizational performance indicators. Future researches can extend the findings of this study to develop advanced frameworks and to investigate the case of other countries.

Keywords: *SCM, BPM, competitive advantage, organizational performance*

1. Introduction

Today's fierce competition situation in business world have already required organizations to improve not only their internal business process, but their entire supply chain to be made competitive (Li *et al.*, 2005; Youn, 2013; Li *et al.*, 2006; Agus, 2011, Chang and Park 2017). Therefore, the understanding and practice of supply chain management (SCM) and business process management (BPM) across their own companies necessary for any company, regardless of the nature of their business, to remain competitive and profitable.

SCM encompasses materials and supplies management from the supply of basic raw materials to final product (and possible recycling and re-use). It focuses on how firms utilize their suppliers' processes, technology and capability to enhance competitive advantage. It is a management philosophy that extends traditional intra-enterprise activities by bringing trading partners together with the common goal of optimization and efficiency (Tan *et al.*, 1998). It is an integrative approach to dealing with the planning and control of the materials flow from suppliers to end-users (Tan, 2001). A network of firms interacting to deliver product or service to the end customer, linking flows from raw material supply to final delivery (Ellram, 1990). The council of logistics management (CLM) defined SCM as a systemic and strategic coordination of traditional business practices across all those business functions within a particular organization and across entities involved in the entire supply chain for the purpose of long term improvement of individual organizations and the supply chain as a whole (CLM, 2000).

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As mentioned SCM in Chang and Park 2017, BPM is defined as all efforts in an organization to analyze, and continually improve all activities and operations of the organization (Zairi, 1997; Trkman, 2010; Skrinjar and Trkman, 2013). In order to survive in the ever changing business environment, companies must implement best management practice principles, strategies and technologies (Hung, 2006; Carpinetti *et al.*, 2003). BPM is regarded as best practice management principle that helps companies to build and sustain their competitive advantage in the near and far futures.

Many researchers and business organizations still tend to see SCM as integrated logistics management or as a synonymous for supplier management. Some business organizations may realize the importance of SCM yet they don't know what constitutes a comprehensive SCM practices. On the other hand, some see BPM as just simply IT functions of the business organization. For many others it is used only to describe the process oriented philosophy in managing the activities of the organization. In Chang and Park 2017 we have conceptualized the common practices of SCM and BPM and developed 6 research hypotheses.

Following the Chang and Park 2017, this study is therefore to empirically test a framework identifying the relationship between BPM and SCM and their impact on organizational performance with a mediating effect of organizational competitiveness. We try to answer the following specific questions in particular. How and to what extent SCM improves firm's financial and operational performance through improving their competitive advantage? How and to what extent BPM affects overall organizational performance by helping firms to build their competitive advantage? How and to what extent understanding and practice of BPM will help firms to build a competitive SCM practice?

2. Research Hypotheses

In Chang and Park, 2017, they presented an integrated framework of SCM and BPM and 6 research hypotheses. The figure 1 and the followings describe them.

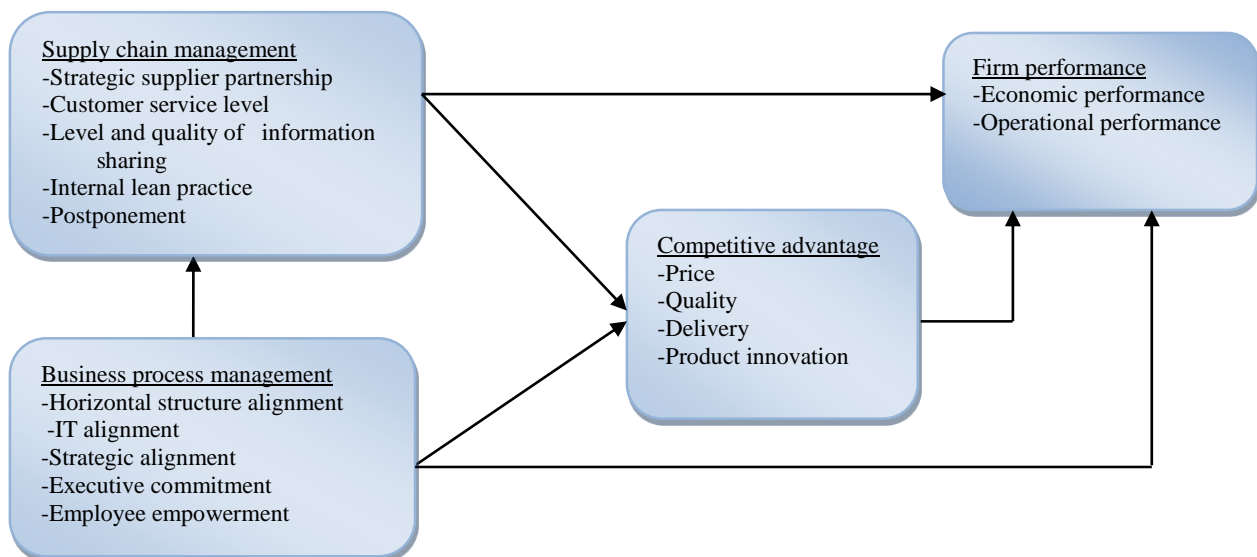


Figure 1. The Conceptual Framework of SCM and BMP (Chang and Park 2017)

H₁: Firms with high level of SCM practice will have high level of market, financial and operational performance.

H₂: Firms with high level of SCM practice will have high levels of competitive advantage

H₃: Firms with high level of BPM practice will have high level of organizational performance.

H₄: Firms with high level of BPM practice will have high level of competitive advantage.

H₅: Firms with higher level of competitive advantage will have high level of organizational performance

H₆: Firms with high level of BPM practice will have a better SCM practice

3. Research Methods

3.1. Survey Administration and Data Collection

Data for this study was obtained from questionnaire based survey. Questionnaire items have been drawn from prior researches after conducting a comprehensive literature review in the field of SCM and BPM. The necessary data to test the hypotheses was collected from a samples of randomly drawn 243 firms from a population of more than one thousand private and public heeled Tanzanian firms who are registered under the Tanzanian Investment Center (TIC) and are currently engaging mainly in manufacturing and service sectors. We primarily targeted individuals, who are either top level executives or middle level managers in procurement/purchasing, marketing/sales, production/operation management departments. We specifically targeted those groups based on the notion that they have a better knowledge on the concepts of SCM and BPM practices. Data collection was done both online and through paper-and-pencil approach. Among the 234 questionnaires distributed, 87 of them responded within the time frame we set (three weeks) yielding a 37% response rate. Among those responses 14 of them were incomplete and were disregarded. The remaining 73 valuable responses were used for further analysis.

Among the 73 respondents, 30 (41%) of them were from production/ operations department and the remaining 26% from marketing/ sales, 19% from purchasing/ procurement and 14% from transportation/ logistics/ distribution department. Also, 44 (61%) of them assume some managerial position and 65 (89%) of them have been working in their position for more than a year. This leads to a conclusion that our respondents have a better understanding of the concepts of BPM and SCM practices. A summary of the demographic data is given in table 3.

Table 3. Description of Demographic Data

Variable	Category	n	%
Firm's industry	Manufacturing	16	22%
	Service	33	45%
	Others	23	32%
Respondent position	Top level manager	10	14%
	Middle level manager	11	15%
	First line Manager	23	31%
	Others	29	40%
Respondent area of expertise	Production/ operations	30	41%
	Purchasing/ procurement	14	19%
	Transportation/ distribution	10	14%
	Marketing/ sales	19	26%
Respondents experience (years)	For more than 10 years	20	27%
	From 6-10 years	14	19%
	From 1-5 years	31	42%
	Less than a year	8	11%

3.2. Response and Common Method Biases

The typical primary concern of a survey method research is that the data collected from the respondents may contain non-response bias which can lead to a sample that is not a true representative of the population (Forza, C. 2002). But, this research did not investigate non-response bias directly because it had no detail information about organizations except the name and address of individual respondents. However, Armstrong and Overton (1977) recommended that late-returned surveys contain the opinion of non-respondents. Based on this assumption, we divide the 73 respondents in to 42 early respondents (those who replied for the first email within 2 weeks) and 31 late respondents (those who replied after follow up email within another 2 weeks). Then we randomly choose 20 variables and conducted an independent t-test between the two groups and there was no statistically significant difference indicating that non-response cannot be a significant concern.

The other similar concern of a survey method is the common method bias (CMB) which refers to variance attributed to the measurement model rather than the constructs. Since data was collected from a single respondent per organization, it is necessary to check for CMB. Harman's single factor method was applied using CFA in order to confirm the absence of significant CMB problem. According to Podsakoff *et al.*, (2003), a single factor CFA should fit the data well. The AVE by a single factor was found to be 24%, indicating that very less variation of the data is accounted for by a single factor. This suggests that CMB is not a great concern hence, further analysis are appropriate.

3.3. Measures

3.3.1. SCM

SCM was treated as a five dimensional factor and measured with a total of 23 items all derived from Li *et al.*, (2006) and Li *et al.*, (2005). (1) *Strategic supplier partnership* was measured by 5 items, *e.g.*, "We consider our suppliers in our planning activities". (2) *Customer service level* was measured by five items. (*e.g.*, "We frequently interact with customers to set reliability and responsiveness"). (3) *Level and quality of information sharing* was also operationalized with five items, including, "The information exchange between our trading partners and us is mostly accurate, complete and timely". (4) *Internal lean practice* was measured using five items developed by Li *et al.*, (2005) and Agus (2011) (*e.g.*, "Our firm has continuous quality improvement program". (5) Finally, three items were adapted from Li *et al.*, (2006) to measure *postponement* (*e.g.*, "We delay final product finishing activities until we receive actual orders").

3.3.2. BPM

Like that of SCM, BPM is also considered as a higher order factor comprised of four dimensions. All items were adapted from Hung (2006). (1) *Horizontal structure alignment* was measured with a total of five items (*e.g.*, "There are no high barriers between our departments"). (2) *IT alignment* is another dimension of BPM measured by four items (*e.g.*, "We have a well integrated IT system across functional units"). (3) *Strategic alignment* was assessed using three items such as "Our strategies are developed based on customer needs". (4) *Executive commitment* another important dimension of BPM was measured by four items (*e.g.*, "[Our] Executive allocates adequate resources to improve core processes". (5) Lastly, *employees' empowerment* was measured using three items including "Employees' autonomy in decision making at their work is increasing".

3.3.3. Competitive Advantage

The four sub-dimensions of competitive advantage were measured by a total of 15 items adapted from Li et al. (2005) and Li *et al.*, (2006). (1) *Price* was operationalized through three items (*e.g.*, “We offer a very competitive price”). (2) *Quality*, also measured using three items, (*e.g.*, “We offer highly reliable products compared to our competitors”), is another important measure of firms’ competitiveness. (3) *Delivery* was measured by three items including “We deliver the needed product on time”. (4) Last but not least, *product innovation* was assessed using four items (*e.g.*, “We respond well to customer demand for new and additional features”).

3.3.4. Organizational Performance

Firms’ performance can be measured through their economic achievement (marketing performance and profitability) as well as their operational effectiveness. (1) *Economic performance* was measured using six items derived from Li *et al.*, (2006) (*e.g.*, “Our profit margin on sales has been increasing”) whereas (2) *Operational performance* was measured by six items adapted from Kaynak and Hartley (2008) (*e.g.*, “Total inventory turnover has been improved”).

4. Research Results and Discussion

4.1. Measurement Validation

Following Anderson and Gerbing’s (1988) recommendation, a two-step approach was used for structural equation model (SEM) analysis. In the first step, measurement model was tested and reliability, convergent validity, and discriminant validity are checked. In assessing the reliability of the constructs, we used both Cronach’s alpha and composite reliability approach (Fornell and Larcker, 1981). All the values were well above the threshold (>0.7) with values ranging from 0.7529 to 0.9594 as shown in appendix A.

We used partial least square (PLS) based SEM to test the structural model. We favored PLS-SEM over covariance based SEM (CB-SEM), due to the advantages that the former can bring, such as, (1) it does not require the data to follow normality; (2) can be applied when the researcher has fewer indicators; (3) large number of indicators can be included in the model; (4) it assumes all measured variance (including error) is useful for explanation and prediction of the relationship (Hair, 2011; Afthanorhan, 2013). Since all factors included in this study are second order variables, we used a “reflective – formative” base confirmatory factor analysis (CFA) known as “hierarchical component model” (HCM) in PLS-SEM. HCM helps researchers to reduce number of indicators in SEM besides making the entire model more parsimonious. It is proved to be very essential when constructs are highly correlated which makes the estimation more biased to multicollinearity (Afthanorhan, 2014).

SCM practice was conceptualized as a five dimensional second order factor (SP, CS, QI, LP and PP). Likewise, BPM is also a four dimensional second order construct composed of SA, HA, IA, EC, and EE. Competitive advantage was measured using PR, QL, DL and PI sub-scales. Finally, overall organizational performance consists of EP and OP. We conducted a series of CFA and the appropriateness of second order factor was justified for SCM, BPM, competitive advantage and organizational performance.

Convergent validity was assessed for each sub-scale under each respective higher order factors by examining the standardized factor loadings presented in appendix A. The values suggest that all the items loadings were significant on their posited constructs ranging from 0.7059 to 0.9595. Also, if the average variance extracted (AVE) for each construct is greater than 0.50, the convergent validity is established (Fornell and Larcker, 1981). The AVE values for each construct were well above the threshold ranging from 0.5895 to 0.8873 (see appendix A).

Discriminant validity was examined following the method suggested by Fornell and Larcker (1981). The square root of AVE for each constructs along the diagonal was quite greater than the correlations with other constructs. The other way of assessing discriminant validity is to see the cross loadings of items. In this case, all the items were found to be loading higher to the construct it intended to measure than with other constructs. The significance of formative relationship between first and second order constructs were assessed by the weights of each path. As shown in appendix A, all the weights were significant with t-value ranging from 1.9800 to 19.6675.

4.2. Testing the Structural Model

In the second step, the structural model is evaluated. The composite score of second order constructs were used to model the final SEM path structure Figure 2.

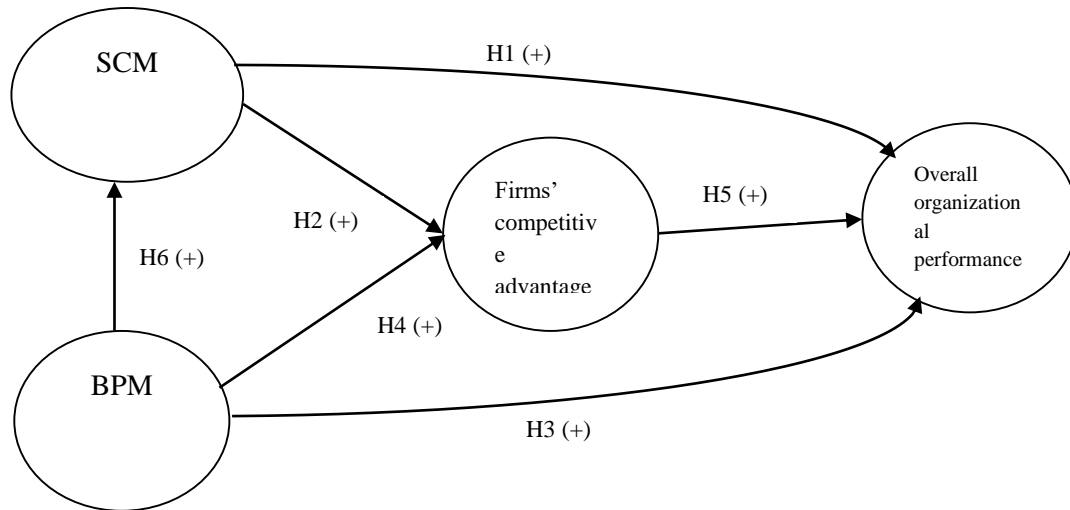


Figure 2. The SEM Final Structure

Multicollinearity was assessed using the variance inflation factor (VIF) method. All the values were found to be below the 5.0 standard (Hair *et al.*, 1998). Therefore, multicollinearity was assessed and there was no multicollinearity problem among the independent variables as shown in table 4. Cohen (1998) suggests that R^2 value, >0.26 as substantial, >0.13 as moderate and > 0.02 as weak indication of explained variation of an endogenous variable by a given exogenous indicator. Table 4 presents R^2 values of each endogenous variable. All values were well above the “substantial” threshold. Predictive relevance of a reflective endogenous variable can be tested using Q^2 and according to Chin (1998), Q^2 value greater than zero indicates that the respective endogenous variable has a significant predictive relevance. As shown in table 4, all Q^2 values were well above zero hence predictive relevance has been achieved.

The effect size f^2 is used to assess the impact of a specific predictor (exogenous) variable on an endogenous variable. The value of f^2 tells what happens to the R^2 value of an endogenous variable when a specific predictor variable is omitted from the model. Cohen (1988) suggests that f^2 value > 0.35 represents strong effect size while > 0.15 shows moderate effect size and > 0.02 indicates a weak effect size. In our case, all exogenous variables’ effect size value ranges between moderate to strong effect size (Table 4).

Table 4. Summary of Multicollinearity, R², Predictive Relevance and Effect Size Results (n =73)

	VIF	R ²	Q ²	f ²	
				CA	OP
BPM	2.999	-	-	0.131597	-
SCM	2.325	0.6226	0.6203	0.148105	-
CA	3.041	0.5699	0.5375	-	0.442162
OP	-	0.7761	0.7727	-	-

The hypotheses were tested by assessing the direction, strength, and level of significance of the path coefficients estimated by PLS, using a bootstrap resampling method with 5000 resample following Chin's (1998) suggestion. Sobel's test is used to test the indirect (mediation) effects. Table 5 provides the summary of findings and indirect effects. All the hypotheses were supported at 5% alpha value except hypothesis one which still can be supported at 0.1 alpha level.

Table 5. Path Coefficients and Significance Level (n = 73)

Hypothesis	Independent -> dependent variables	Path coefficients	t- statistics	Significance
H1(+)	SCM -> FP	0.1678	1.6746*	P < 0.01
H2(+)	SCM -> CA	0.4108	2.1786**	P < 0.005
H3(+)	BPM -> OP	0.318	2.9987***	P < 0.001
H4(+)	BPM -> CA	0.3874	2.379**	P < 0.005
H5(+)	CA -> OP	0.4798	4.043***	P < 0.001
H6(+)	BPM -> SCM	0.1678	14.2108***	P < 0.001

*hypothesis supported at 0.1 alpha level

**hypothesis supported at 0.05 alpha level

***hypothesis supported at 0.001 alpha level

Sobel's test is used in testing the statistical significance of indirect (mediating) relationship between an independent construct and a dependent through a mediator (Daniel, S. Soper, 2004). The test generates t-statistics and p-values for the indirect path. All the mediators were found to be significant (Table 6).

Table 6. Sobel's Test of t- statistics (and p-value) for Indirect Paths (n = 73)

Latent variable	Linkage	Path	
		CA	OP
BPM	CA		2.1297(0.0367)
	SCM	2.2290(0.0258)	
SCM	CA		1.967 (0.0403)

5. Implications and Limitations

Much of the current theoretical and empirical research on SCM focuses only on downstream or upstream of the supply chain or certain perspectives of SCM. Similarly, while there has been much research on business process modeling techniques and corresponding tools, there has been little empirical research into the success factors of BPM and its impact on firms' competitiveness and overall performance. Moreover, to the best of our knowledge, despite the existing relationship between the practice of SCM and

BPM, no prior research has investigated the relationship between this two business management practices and their synergistic impact on firms' overall performance. Therefore, this study will contribute for future researches to look into the inter-relationship between SCM and BPM in detail and also to investigate the combined effect of the practices of both business principles on organizations competitive advantage and also their impact on firms' economic, operational and other performance measures.

It is important to note that some other contextual factors that are not considered in this study; such as, industry, firm size, the nature (length and complexity) of the supply chain are very important factors for SCM practice. For example, customer service level may be more important for service rendering firms than manufacturing firms. Or, such factor could be very important for firms found at downstream in the supply chain than firms found at upstream. Internal lean practice and postponement are less important for downstream supply chain activities. Hence, these are less important SCM practices for distributors and retailers. Larger firms have the necessary resource to commit for the adoption and implementation of new technologies and innovations, hence, the larger the firm the more likely to adopt BPM practices and applications. Therefore, future studies can target specific industry or group of firms found at the same level in the supply chain network. It might also be important to look in to the group of firms with same size and nature of the business operation separately. Some factors like organizational size can be controlled variables for future studies. Lastly, this study has relied on a sample of 73 Tanzanian firms. Therefore, it is important to consider more firms and more country cases for stronger generalization of findings.

6. Conclusion

To conclude, this research investigated the two important business practices of the 21st century firms, *i.e.*, SCM and BPM. We have assessed their synergistic effect in building firms' competitive advantage and ultimately improving their economic and operational performance. Using measurement items adopted from prior studies, a survey was conducted at firm level in the case of Tanzania. After conducting a thorough measurement validation, the proposed structural model was assessed using PLS-SEM method. The empirical analysis results shows that supply chain and business process practices are significant contributors for firms' short and long term economic and operational performance through building organizational competitive advantage.

Appendix A

Table Summary of measurement scale

Factor	Item	Mean	S.D	Loadings ^a	Alphas ^b	CR ^c	AVE ^d	Path Coefficients
SCM	SP1	3.89	1.08	0.7059	0.827	0.877	0.589	8.5209
	SP2	3.60	1.15	0.7637	4	2	5	
	SP3	3.67	1.06	0.8629				
	SP4	3.62	.995	0.7841				
	SP5	3.63	.993	0.712				
Customer service level	CS 1	3.84	1.11	0.7823	0.904	0.929	0.725	12.4931
	CS 2	3.73	.902	0.8502	7	4	3	
	CS 3	3.84	1.06	0.8275				
	CS 4	3.89	1.08	0.9163				
	CS 5	3.81	.938	0.876				
	CS 6							
	CS 7							

	5							
Level and quality of information sharing	3.60	1.11		0.905	0.929	0.725		
	QI1	5	0.8577	5	5	3		11.3923
	3.59	1.01						
	QI2	2	0.8122					
	3.44	1.01						
	QI3	4	0.8675					
	QI4	3.55	.972	0.8444				
	3.68	1.07						
	QI5	9	0.8751					
Internal Lean Practice	3.33	.883		0.887	0.917	0.688		
	LP1		0.8293	1	1	9		11.2732
	3.45	1.11						
	LP2	9	0.844					
	LP3	3.15	.908	0.8335				
	LP4	3.29	.993	0.8516				
	3.47	1.08						
	LP5	1	0.7901					
Postponement	3.14	1.00		0.752	0.859			
	PP1	4	0.878	9	1	0.671		8.1864
	3.34	1.12						
	PP2	1	0.7628					
	3.32	1.11						
	PP3	1	0.8126					
BPM								
Horizontal structure alignment	HA	3.53	1.11			0.662		
	1		9	0.8277	0.873	0.907	1	12.3077
	HA	3.58	1.12					
	2		3	0.8842				
	HA	3.53	1.13					
	3		1	0.8425				
	HA	3.47	1.02					
	4		9	0.7255				
	HA	3.64	.806					
	5			0.7793				
IT alignment	3.59	1.11			0.946	0.816		
	IA1	6	0.8674	0.925	8	5		19.6675
	3.49	1.14						
	IA2	4	0.9146					
	IA3	3.71	.993	0.9224				
	3.77	1.14						
	IA4	9	0.9088					
Strategic Alignment	SA	3.73	1.04		0.907	0.844		
	1		4	0.9006	7	0.942	2	15.1991
	SA	3.84	.928					
	2			0.9354				
	SA	3.90	1.04					
	3		3	0.9201				
Executive Commitment	EC	3.54	1.08		0.915	0.940	0.798	
	1		7	0.8731	7	6	5	14.5842
	EC	3.63	.950					
	2			0.93				
	EC	3.73	.821					
	3			0.8876				
	EC	3.70	.953					
	4			0.8826				
Employee Empowerment	EE	3.64	1.12		0.936	0.959	0.887	
	1		3	0.9497	3	4	3	13.5949
	EE	3.59	1.06					
	2		5	0.9595				
	EE	3.63	1.00					
	3		7	0.9161				
Firm competitive advantage (CA)								
Price	PR	3.66	1.00	0.9169	0.883	0.927	0.809	10.2707

		1	3		1	4	8	
		PR	3.51	.959				
		2			0.8736			
		PR	3.63	.993				
		3			0.9086			
		QL	3.92	.983		0.921	0.950	0.864
Quality		1			0.9288	4	2	1
		QL	3.75	1.02				
		2			0.9395			
		QL	3.75	.997				
		3			0.9202			
		DL	3.78	.932		0.891	0.932	0.821
Delivery		1			0.9053	2	4	5
		DL	3.74	.866				
		2			0.9389			
		DL	3.84	.850				
		3			0.8738			
			3.60	.939		0.900	0.930	0.769
Product Innovation		PI1			0.8675	4	4	9
		PI2	3.59	.969	0.8342			
			3.56	1.00				
		PI3		0	0.8869			
			3.68	1.07				
		PI4		9	0.919			
Organizational performance (OP)								
			3.60	1.02		0.947	0.958	0.793
Economic performance		EP1		4	0.8193	7	4	6
		EP2	3.59	.925	0.8962			
			3.71	1.09				
		EP3		9	0.9009			
		EP4	3.58	.985	0.9066			
		EP5	3.62	.967	0.8951			
			3.59	1.02				
		EP6		5	0.9233			
		OP	3.62	.892		0.930	0.945	0.742
Operational performance		1			0.8974	2	2	3
		OP	3.62	.844				
		2			0.9123			
		OP	3.70	.982				
		3			0.8543			
		OP	3.77	.808				
		4			0.8247			
		OP	3.59	.925				
		5			0.8248			
		OP	3.60	.924				
		6			0.8519			

*a All items loadings are significant at $p < 0.001$

*b Cronbach's alpha value

*c CR = composit score

*d AVE = average variance extracted

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