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THE EFQM EXCELLENCE MODEL AS ENABLER OF E-PROCUREMENT ADOPTION AND THE EFFECT ON PERFORMANCE

Abstract

The objective of this paper is to examine the EFQM Excellence Model as an enabler of E-procurement adoption and the effect on purchasing performance. The study utilized a cross-sectional telephone survey of a sample of Spanish manufacturing companies using multiple informants. A total of 200 firms responded making a total of 800 responses. Data was analyzed using structural equations modelling. The results indicate that the Business Excellence Enablers (Leadership, Strategy, People, Resources, and Processes) act as enablers of E-procurement and help to realize gains in purchasing performance.

Keywords: E-procurement, EFQM Excellence Model, empirical study, structural equations modelling

1. Introduction

For most businesses today investment in information technology (IT) is crucial for the success of their business. All departments of a firm use of some type of information technologies to manage its operations and the purchasing function is of no exception. As such, the use of information technologies to facilitate business-to-business purchase transactions for materials and services, E-procurement, is becoming increasingly recognized for its ability to improve business operations.

E-procurement is a recent topic of investigation and receiving growing interest among researchers. Recent work has also paid considerable attention to the risks and benefits of E-procurement and the effect on performance (Claassen *et al.*, 2008; Devaraj *et al.*, 2007; Mishra *et al.*, 2007; Quesada *et al.*, 2010; Saeed *et al.*, 2005; Sanders, 2007; Tai *et al.*, 2010; Trkman and McCormack, 2010; Vaidyanathan and Devaraj, 2008; Wu and Ross, 2007) but most of the recent research has been devoted to analyzing the adoption and use of E-procurement technology and facilitating factors (Quesada *et al.*, 2010; Sanders, 2007; Wu and Ross, 2007; Abdullah and Hashim, 2010; Aboelmaged, 2010; Azadegan and Teich, 2010; Chang and Wong, 2010; Chang and Wong, 2010; Gunasekaran *et al.*, 2009; Gunasekaran *et al.*, 2009; Othman *et al.*, 2009; Archer *et al.*, 2008; Gunasekaran and Ngai, 2008; Gunasekaran and Ngai, 2008; Smart, 2010; Soares-Aguiar and Palma-dos-Reis, 2008; Walker and Harland, 2008; Zheng and Wang, 2008; Caniato *et al.*, 2010; Chang *et al.*, 2008; Davila *et al.*, 2003; Johnson *et al.*, 2007). We further this line of research by analyzing the facilitating effect of business excellence enablers as defined by the EFQM Excellence Model on E-procurement and the impact on purchasing performance.

The rationale for analyzing this relationship is twofold. First, much of the attention that IT has received in the operations literature today is due to the diffusion of TQM principles (Gunasekaran and Ngai, 2004), and the EFQM Excellence Model is a valid representation of the total quality management (TQM) principles (Bou-Llusar *et al.*, 2009). Second, the EFQM Excellence Model considers several technological, organizational and environmental factors in its five enabling constituents (Leadership, Strategy, People, Resources, and Processes) as well as performance results, thus providing an effective framework to analyze the facilitators of E-procurement and the effect on performance.

Also, given that most of the studies in E-procurement have focused on large enterprises (Devaraj *et al.*, 2007; Quesada *et al.*, 2010; Tai *et al.*, 2010; Smart, 2010) we decided to undertake this study in the context of medium enterprises, that is, businesses between 50 and 500 employees. Small and medium size Enterprises (SMEs) provide a large proportion of the employment in developed economies. In the context of E-procurement, medium sized organizations are large enough to be able to afford the adoption of E-procurement tools but their relatively small sized compared to large organizations might require a different set of factors in order to E-procurement tools to be effective. It is for this reason that we focus our study in medium sized enterprises as opposed to large and small enterprises.

Arguments for the relationship between the Business Excellence Enablers and E-procurement can be found in the resource based view of the firm (Peteraf, 1993; Barney *et al.*, 2001; Barney, 1991; Barney, 1986), and the notion of resource complementarity. Complementarity represents an enhancement of resource value, and arises when a resource produces greater returns in the presence of another resource than it does alone. Thus, we argue that E-procurement and the Business Excellence Enablers are complementary resources and that makes E-procurement have a positive effect on performance. Finally, this paper adopts a functional perspective and focuses on E-procurement and operational performance in the context of the purchasing function. This performance is measured according to the achievements made within each of the four basic competitive priorities for the purchasing function: cost, quality, dependability and flexibility. In addition to that, according to Kim *et al.* (2010), there is a value added in discussing the Business Excellence Enablers in the context of other important themes in operations

management research such as Supply Chain Management, considered as one of the strong themes in a cross enterprise and cross functional context.

Consequently, this paper will try to answer the following research question, are the Business Excellence Enablers effective facilitators of E-procurement and do they generate a positive effect on purchasing's performance? In order to respond to this question we hypothesize a research model including the Business Excellence Enablers, E-procurement, and purchasing performance, and test it using structural equations modelling analysis and survey data from 200 manufacturing firms in Spain.

2. Literature Review and Research Framework

2.1 E-procurement

E-procurement could be defined as the use of information technology for obtaining materials and services and managing the information flow between the firm and its suppliers (Wu and Ross, 2007; Aboelmaged, 2010). We will distinguish between two types of E-procurement attending to the degree of collaboration between supplier and buyer in the activities supported by information technology: *Transactional E-procurement* and *Coordination E-procurement* (Wu and Ross, 2007; Soares-Aguiar and Palma-dos-Reis, 2008). Transactional E-procurement applications enhance the efficiency of procurement processes such as acquiring and processing information for decision making, accounting, planning and control processes and include, searching for suppliers, negotiating contracts, placing and tracking orders with suppliers. On the other hand, Coordination E-procurement applications can facilitate the information exchange of product designs and database integration, and are more strategic in nature because they focus more on inter organizational integration. Coordination E-procurement includes practices such as sending new product updates to suppliers, providing product specifications to suppliers, sharing inventory planning with suppliers and direct linking databases through ERP systems (Wu and Ross, 2007).

2.2 Business Excellence Enablers

We define Business Excellence Enablers in terms of the EFQM Excellence Model. The EFQM Excellence Model is a framework to assess organizations for the European Quality Award and its main objective is to support organizations to achieve business excellence through continuous improvement and deployment of processes. The model is divided into two areas – i.e. enabler and results. The enabler side of the model is defined by five components, i.e., leadership, strategy, people, resources, and processes. The results area is comprised of four performance elements –i.e. people results, customer results, society results, and key results – and the model assumes that excellent performance is derived through the five enablers.

2.3 Theoretical Background and Hypotheses

Arguments for the value of Business Excellence Enablers to support IT and more specifically E-procurement find a basis in the resource-based view of the firm (Peteraf, 1993; Barney *et al.*, 2001; Barney, 1991; Barney, 1986), which argues that, to confer competitive advantage, an organization should acquire or develop resources and/or capabilities that contribute positively to performance, are not possessed by all competing firms, and are difficult to imitate or duplicate (Barney, 1986). These resources and capabilities can either be acquired in factor markets and/or developed inside the firm. Information technology, as part of a firm's resource portfolio, may not meet the resource-based view criteria when acting alone. Due to the relatively low barriers to imitation and acquisition by other firms, an IT-based advantage tends to diminish fairly quickly. In contrast, the resource-based view has emphasized sustainability protected by resource embeddedness, i.e., resource complementarity and co-specialization (Powell and Dent-Micalef, 1997). As mentioned earlier, complementarity represents an enhancement of resource value, and arises when a resource produces greater returns in the presence of another resource than it does alone.

Based on this definition of resource complementarity, one could argue that the Business Excellence Enablers and E-procurement are complementary resources. Previous research supports this view. Brah and Lim (2006) found that TQM and technology play important and complementing roles in improving performance. Their analysis showed that both high technology firms and high technology TQM firms perform significantly better than their low technology peers. And Laframboise and Reyes (2005) showed how TQM efforts are an antecedent to ERP implementation and that TQM efforts include some of the building blocks necessary for successful implementation of ERP systems. The same rationale could be applied to the relationship between Business Excellence Enablers and E-procurement.

Thus, we propose that the Business Excellence Enablers act as a unified enabler of E-procurement. The supply management literature also supports the positive relationship between the building blocks of the Business Excellence Enablers (Leadership, Strategy, People, Resources, and Processes) and E-procurement. For example Gonzalez Benito (2007) showed that strategic purchasing is an antecedent to the implementation of information technology in purchasing. Hemsworth *et al.* (2008) showed that quality management practices are an antecedent of information systems in purchasing. Thus, in accordance with the literature, the following hypotheses were formulated:

H1: Business Excellence Enablers has a positive effect on Transactional E-procurement (H1a) and Coordination E-procurement (H1b)

H2: Business Excellence Enablers has a positive effect on purchasing performance

H3: Transactional E-procurement (H3a) and Coordination E-procurement (H3b) have a positive effect on purchasing performance

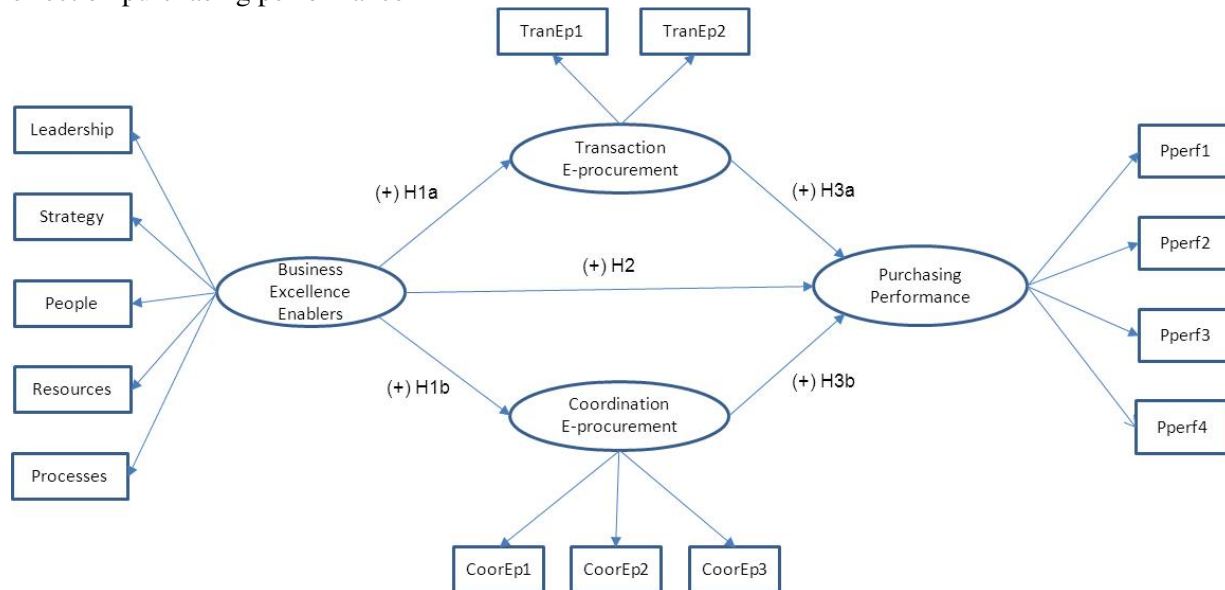


Figure 1. Research framework and hypothesis

4. Methodology

4.1. Sample and Data Collection

Data was collected via both telephone and web survey. Most companies responded to the questionnaire online although some managers preferred to answer the questionnaire via telephone. The distinctive characteristic of this research is that senior managers from four departments (Quality, Purchasing, Human Resources and Marketing) were interviewed in each company. Each questionnaire had a common part addressed to all managers and a specific part addressed to the Purchasing Manager (questionnaire can be obtained from the first author upon request). With this methodology common method bias response is avoided particularly in those questions addressed to all managers. The questionnaires were pretested by four faculty members as well as by several industry practitioners.

A total of 3814 companies comprised the original population of Spanish industrial companies between 50 and 500 employees and was obtained from the SABI's (*Sistema de Análisis de Balances Ibéricos*) financial database. Companies in the database were randomly ordered and then contacted via telephone. The objective was to gather data from about 200 companies (800 completed questionnaires). A total of 200 valid questionnaires were received making a response rate of 5.3% and a total of 800 valid complete responses. In estimating a structural equations model it is important to determine the minimum sample size required in order to achieve a desired level of statistical power with a given model prior to data collection (McQuitty, 2004). Although there is no single recommended sample size for SEM, several authors have suggested a sample size above 200 provides sufficient statistical power for data analysis (Garver and Mentzer, 1999).

In order to analyse any differences between firms in the sample and the population, we correlated the number of companies in each industry in the population with the number of companies in each industry in the sample. The Pearson correlation was 0.759 and significant at the 1% level indicating that the sample is a good representation of the population in terms of industry distribution. Differences in company size by number of employees and operating income were also assessed in order to assess whether the sample was representative of the population. The analyses of variance (ANOVA) results indicated that there were no significant differences between sample and population in terms of average number of employees ($p > 0.10$) and average operating income ($p > 0.10$). Therefore it could be concluded that the firms in the sample are representative of the firms in the population.

4.2. Construct Measurement

The Business Excellence Enablers construct was measured using a five-point scale where respondents were asked to indicate their extent agreement or disagreement the listed statements (1 = totally disagree; 5 = totally agree) (see Table 2). The measurement of E-procurement was based on the previous literature (Wu and Ross, 2007; Chang and Wong, 2010; Archer *et al.*, 2008; Soares-Aguiar and Palma-dos-Reis, 2008; Zsidisin, 2002; Talluri *et al.*, 2007). Respondents were asked to report their level of usage of information technologies in E-procurement activities using a five-point scale (1 = no use, 5 = intensive use) (see Table 3).

5. Data Analysis

The analysis was carried out with LISREL 8.5 using the maximum-likelihood estimation method. The assumptions of multivariate analysis – normality, linearity, and homoscedasticity – were tested for the variables used in the measurement model and the data showed high kurtosis statistics; thus, normal scores of variables were calculated using PRELIS and these scores were used in the analyses (Jöreskog *et al.*, 2000). In order to assess the proposed model in Figure 1 we first had to establish the validity and reliability of the Business Excellence Enablers (Anderson and Gerbing, 1988). A Confirmatory Factor Analysis (CFA) was undertaken for this purpose and the results are reported in Table 2. As recommended by many researchers, multiple fit criteria are presented to evaluate the overall fit of the model (Bollen and Long, 1993; Hair *et al.*, 1995). As it can be seen in Table 4 the majority of the fit indices were above the recommended values. All specified factor loadings were highly significant, which indicates good convergent validity among the measures of each Business Excellence Enablers constructs (see Table 2). All constructs displayed composite reliabilities (Hair *et al.*, 1995) in excess of the generally accepted 0.70 value for non-exploratory studies and well above the 0.60 recommended value for exploratory studies (Churchill, 1979)(see Table 5). Thus, these results provide supporting evidence that the scales used in this study are reliable.

Once the validity and reliability of the Business Excellence Enablers was established we calculated aggregate measures for each Business Excellence Enablers construct by calculating the average. These composite scores were then used as manifest measures of the Business Excellence

Enablers in Figure 1. To establish the validity and reliability of the constructs we first assess the measurement model by means of a confirmatory factor analysis. The fit indices results are shown in Table 4 indicating a good fit. The same validity and reliability tests performed with the Business Excellence Enablers were also performed with the model in Figure 1. The results are displayed in Table 3.

<i>Code</i>	<i>Construct /Item</i>	<i>Mean</i>	<i>SD</i>	<i>Std Loads*</i>
<i>Leadership</i>				
Leader1	Top management listens and respond to the needs of employees and management that form the organization	4.51	0.58	0.767
Leader2	Acknowledges the efforts of people and teams in all levels of the organization	3.77	0.71	0.952
Leader3	Communicates changes and their motives to employees and other stakeholders affected	3.77	0.68	0.866
<i>Strategy</i>				
Strat1	We monitor, identify and analyze developments that affect our market and competitors	3.51	0.59	0.791
Strat2	We analyze data about the competitive position of our firm	3.61	0.59	0.842
Strat3	The company's policy and strategy is in alignment with the company's vision and mission	3.90	0.54	0.711
<i>People</i>				
People1	We develop training and development plans to meet our current and future competencies	3.79	0.64	0.800
People2	We promote and support individual's and team participation in improvement activities	3.95	0.57	0.771
People3	We recognize employees for their involvement and assumption of responsibilities	3.83	0.62	0.841
<i>Resources</i>				
Resour1	We use information technology to improve the effectiveness of the organization	3.77	0.53	0.913
Resour2	Access to information is facilitated to all those who should know about it	3.76	0.52	0.911
Resour3	Innovation and creativity are facilitated through the use of information and knowledge	3.76	0.56	0.941
<i>Processes</i>				
Process1	We set performance objectives and implement process indicators	4.07	0.68	0.722
Process2	We assess the effectiveness of processes in order to execute the company's policy and strategy	3.38	0.48	0.805
Process3	We identify and prioritize opportunities for continuous improvement	4.71	0.46	0.496

Note: *All Standardized factor loadings are significant at $p < 0.01$ two tailed

Table 2. Business Excellence Enablers descriptive statistics and measurement model.

4.2. Hypothesis Testing

Prior to assessing the study's hypotheses, we first evaluated the structural model (i.e., measurement and path model combined) (Bollen and Long, 1993). The structural model displayed a good fit as indicated by the model fit statistics in Table 4. The hypothesized model (Figure 1) explained 30% of variance of purchasing performance ($R^2 = 0.30$). This suggests that the variance of this construct is only partially explained by the Business Excellence Enablers, Transactional E-procurement, and Coordination

E-procurement constructs. However, the links between the constructs are statistically significant, so it can be stated that the data support the proposed research model, which does require the existence of these links. In addition, the Business Excellence Enablers construct explained 12% of variance of Transactional E-procurement and 28% of variance of Coordination E-procurement.

<i>Code</i>	<i>Construct /Item</i>	<i>Mean</i>	<i>SD</i>	<i>Std Loads*</i>
<i>Business Excellence Enablers (BusExEn)</i>				
Efqm1	Leadership	3.72	0.65	0.655
Efqm2	Strategy	3.67	0.49	0.844
Efqm3	People	3.85	0.53	0.836
Efqm4	Resources	3.76	0.51	0.840
Efqm5	Processes	4.05	0.44	0.824
<i>TranEp Transactional E-procurement</i>				
TranEp1	Processing of purchasing documents (purchase order, receipt of goods and services, payment to suppliers)	3.63	0.96	0.884
TranEp2	Creation and maintenance of suppliers database	3.60	0.95	0.771
<i>CoorEp Coordination E-procurement</i>				
CoorEp1	Provide online materials inventory information to our suppliers	2.67	0.95	0.933
CoorEp2	Provide specific online information about product specifications that our suppliers must meet	2.63	0.97	0.949
CoorEp3	Provide online production planning information to suppliers	2.57	0.89	0.939
<i>PPerf Purchasing Performance</i>				
PPerf1	Reduced the cost of making purchase orders	3.38	0.69	0.901
PPerf2	Reduced the duration of the purchasing ordering cycle (from release of the purchase order to the issuing of the payment to the supplier)	3.35	0.69	0.888
PPerf3	Reduced inventory levels	3.40	0.71	0.878
PPerf4	Reduced prices paid for purchases	3.31	0.66	0.920

Note: *All standardized factor loadings are significant at $p < 0.01$ two tailed

Table 3. Business Excellence Enablers, E-procurement and purchasing performance descriptive statistics and measurement model.

	BusExEn	H1-H3		Recommended values
	Measurement Model	Measurement Model	Structural Model	
Degrees of freedom	80	69	70	-
Chi-Square	103.545	82.516	89.76	-
p- value	0.0395	0.127	0.056	>0.05
χ^2/DF	1.285	1.195	1.281	<3
RMSEA	0.0384	0.0314	0.038	0.05
NFI	0.957	0.963	0.96	0.90
NNFI	0.988	0.988	0.98	0.90
CFI	0.991	0.991	0.99	0.95
RMR	0.0349	0.0357	0.04	0.10
GFI	0.935	0.944	0.94	0.80
AGFI	0.903	0.915	0.91	0.80

Table 4. Test results of the measurement models and structural model

Construct	Reliability	AVE	Leader	Strat	People	Resour	BusExEn	TranEp	CoorEp
Leader	0.90	0.75							
Strat	0.83	0.61	0.660*						
People	0.85	0.65	0.761	0.813					
Resour	0.94	0.85	0.642	0.802	0.796				
Proces	0.72	0.47	0.657	0.909	0.940	0.833			
BusExEn	0.90	0.64							
TranEp	0.81	0.69					0.338		
CoorEp	0.96	0.88					0.526	0.506	
Pperf	0.94	0.80					0.438	0.412	0.457

Note: *All correlations are significant at $p < 0.01$ two tailed

Table 5. Correlations, reliability and average variance extracted (AVE)

Independent variable	Dependent variable	Std direct effect	Std indirect effect	Std total effect	Hypothesis	Conclusion
BusExEn	ePtran	0.338*	-	0.338*	H1a	Supported
	ePcood	0.526*	-	0.526*	H1b	Supported
	Pperf	0.252*	0.186*	0.438*	H2	Supported
TranEp	Pperf	0.219*	-	0.219*	H3a	Supported
CoorEp	Pperf	0.214*	-	0.214*	H3b	Supported

Note: * significant at $p < 0.05$ two tailed

Table 6. Summary of statistically significant standardized effects and hypotheses tests

The test of hypotheses was based on the structural coefficients among the constructs as reported in Table 6. These coefficients were tested at the significance level $p < 0.05$ two tailed (t -value of 1.96). Hypothesis 1a proposed a positive relationship between Business Excellence Enablers and Transactional E-procurement. This hypothesis was supported since the standardized coefficient was 0.34 and statistically significant ($t = 4.205$; $p < 0.01$; Table 6). Hypothesis 1b proposed a positive relationship between Business Excellence Enablers and Coordination E-procurement. This hypothesis was supported by a statistically significant structural coefficient of 0.526, ($t = 7.354$, $p < 0.01$; Table 6). Hypothesis 2 proposed a positive relationship between Business Excellence Enablers and purchasing performance. This hypothesis was also supported with a standardized coefficient of 0.252 ($t = 3.091$; $p < 0.01$; Table 6). Hypothesis 3a proposed a positive relationship between Transactional E-procurement and purchasing performance. This hypothesis was also supported with a standardized coefficient of 0.219 ($t = 2.532$; $p < 0.01$; Table 6). Hypothesis 3b proposed a positive relationship between Coordination E-procurement and purchasing performance. This hypothesis was also supported with a standardized coefficient of 0.214 ($t = 2.438$; $p < 0.01$; Table 6).

5. Discussion and Implications

The results of this research provide support for the relationship between Business Excellence Enablers and E-procurement. The results from this study seem to suggest that the Business Excellence Enablers facilitates the adoption of information technology in order to support and improve business processes. This finding is important because it suggests that Business Excellence Enablers provides a good set of factors (Leadership, Strategy, People, Resources, and Processes) that facilitate the adoption and use of E-procurement.

This finding supports previous research that identified top management leadership, personnel readiness, and adequate information technology infrastructure as factors facilitating the adoption of E-procurement (Soares-Aguiar and Palma-dos-Reis, 2008; Zsidisin, 2002). However, it also extends it by

considering additional factors such as, innovation culture and business process evaluation which are contained in the Resources and Processes enablers of the Business Excellence Enablers and have not been previously considered in the literature.

The results also suggest that the Business Excellence Enablers provides support to supply chain management practices as suggested by the positive relationship between Business Excellence Enablers and Coordination E-procurement. This result are in line with recent quality management and supply chain management literature (e.g.(Kaynak and Hartley, 2008; Kaynak, 2003)) and extend it by considering additional factors such as process evaluation and innovation culture and by considering all of them into a comprehensive management system.

We also find strong evidence of the causal relationship between the E-procurement and purchasing performance. The high value of the structural coefficient (0.841) and the high proportion of variance of the result excellence explained by Transactional E-procurement and Coordination E-procurement (70%) indicate that E-procurement has an effective influence on purchasing performance. Specifically, the use of Transactional E-procurement, that is, the use of information technology to support transaction activities such as purchase requisitions, requests for proposals, requests for quotations and the purchase order, reduces the cycle time in issuing and executing a purchase order. This reduction in cycle time has direct repercussions on purchasing costs. The use of E-procurement technology also reduces the errors in purchasing transactions increasing data accuracy, therefore improving decision making.

Specifically, Coordination E-procurement improves reduces inventory and reduces errors in transactions by informing suppliers specifically with the specifications and other characteristics that their orders need to meet in order to meet the buying requirements. In addition, the sharing of inventory and production planning information with suppliers reduces inventory and increases supplier responsiveness since suppliers can better plan their activities and anticipate to changes in customer demand. In turn, all these benefits result in better supply chain performance.

From a methodological point of view this study is based on the analysis of the perceptions of four managers in each company. This is important in order to ensure the validity of the study results since. It also shows how the perceptions of the four managers share a large level of agreement. Other studies had used perceptions from two managers what is known as dyads but this study goes further to include the perceptions from managers in different business areas in order to evaluate the Business Excellence Enablers.

6. Conclusions

The main objective of this paper was to deepen our understanding of the facilitating factors of E-procurement by looking at a set of Business Excellence Enablers and the effect on purchasing performance. Using the resource-based view of the firm and data collected from four managers in 200 manufacturing firms we found that Business Excellence Enablers (Leadership, Strategy, People, Resources, and Processes) act as facilitators of E-procurement and help to realize gains in purchasing performance.

From a theoretical point of view this research has provided evidence that supports the existence of a positive relationship between Business Excellence Enablers and E-procurement and purchasing performance. The results suggest that the Business Excellence Enablers supports the adoption and use of E-procurement for both Transactional E-procurement and Coordination E-procurement. The second theoretical contribution is that Transactional E-procurement and Coordination E-procurement have a positive effect on performance. The fact that Business Excellence Enablers was related to E-procurement and purchasing performance indicates that Business Excellence Enablers should be taken into

consideration in the literature as a facilitator of E-procurement and positive drivers of purchasing performance. Lastly, Business Excellence Enablers also showed to have a positive impact on purchasing performance directly and indirectly through E-procurement. This last result supports the argument that quality management and IT are complementary resources and that the fusion of management, people, and technology resources, produce a critical distinctive advantage.

At this point, it is important to acknowledge important limitations of our study that might provide opportunities for future research. Though the constructs developed in this study exhibit acceptable reliability for the purposes at hand, future research should refine them and consider adding new indicators. Also, inferences in this study are based on cross-sectional data which make causal claims difficult; a longitudinal study could help solve this problem. Despite these limitations, this study paves the way for researchers and managers to more fully capitalize on the potential of the integration between information technology and quality management to foster a firm's quality performance and competitive position.

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