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Successful Supply Chain Practices through Organizational Knowledge and E-Business Technology

[1]P.K. Chen, [2]Chung-Ming Huang and [3]Chun-Hsien Su
[1]Department of Technology Management, Aletheia University, No. 70-11,
Pei-Shi-Liao, Matou, Tainan 721, Taiwan, Republic of China
[2]Department of Engineering and Management of Advanced Technology,
Chang Jung Christian University, Taiwan, Republic of China
[3]Department of Business Administration, Chang Jung Christian University, Taiwan, Republic of China

Abstract: In recent years, organizational knowledge has played an important role in supply chain. Many manufacturers believe that the creation and sharing of organizational knowledge can improve supply chain practices. This study explores, the effect of organizational knowledge on supply chain practices and whether organizational knowledge can be created and shared through e-business. We examine the influence among e-business technology, organizational knowledge, supply chain practices and competitive performance. Present results indicate that organizational knowledge has a positive effect on supply chain practices, leading to competitive performance. Otherwise, organizational knowledge can be created through e-business. In addition, e-business technology can also play a role in knowledge sharing, so as to improve organizational knowledge. This in turn can affect the sharing between supply chain partners, which leads to effective supply chain practices. In this study, we analyze 552 samples from top manufacturing firms based in 24 countries and perform Structural Equation Modeling (SEM) to test our hypotheses.

Key words: Supply chain practice, organizational knowledge, e-business, competitive performance

INTRODUCTION

Over the last 20 years, supply chains have played an important role in improving a manufacturer's competitiveness. Effective supply chain practices can improve supply chains. According to related supply chain research, supply chain practices can be divided into three different categories, including supply chain planning, Just-In-Time (JIT) production and delivery practice (Zhou and Benton, 2007; Chou *et al*., 2008). Flynn *et al*. (1995) and Supply Chain Council (2000) indicated that effective supply chain practices can create powerful competitive performance for manufacturers.

Some practitioners have argued that the creation and application of organizational knowledge can effectively influence supply chain practices. The creation of valuable organizational knowledge under supply chain operations can endow the supply chain with a powerful ability to improve internal activities and create effective supply chain practices. However, it is the creation of valuable organizational knowledge that is important. The creation of valuable organizational knowledge depends on the analysis of related external and internal information. Therefore, information is an input to knowledge (Davenport and Prusak, 1998).

For the gathering and analysis of information related to knowledge creation, research has revealed that building cross-platforms of information technology can be effectively used to gather information, integrate and further analyze it. Adamides and Karacapilidis (2006) indicated that firms can use information technology to organize and integrate data into useful information. Information technology also can support the transformation of information into organizational knowledge. The study has explored the effects of information technology on information and the creation of organizational knowledge. Scott (1998) explored the effects of Intranet technology on organizational knowledge and found that an Intranet can gather, integrate and analyze related information to create, apply and transfer knowledge. Bolisani and Scarso (1999) pointed out that EDI can handle internal or external information, create knowledge and transfer it. Oppong *et al*. (2005), Helms *et al*. (2008) and Wickramasinghe and Mills (2002) indicated that e-business building can improve information gathering,

Corresponding Author: P.K. Chen, Department of Technology Management, Aletheia University, No. 70-11, Pei-Shi-Liao, Matou, Tainan 721, Taiwan, Republic of China

integration, analysis and it can also promote knowledge creation. Based on this, some practitioners believe that e-business can improve information that is gathered and analyzed and create valuable organizational knowledge.

Although, the creation of valuable organizational knowledge through e-business can improve supply chain practices, organizational knowledge must be diffused among partner firms if manufacturers want to promote effective practices with other firms based on organizational knowledge improvement. Based on this, some practitioners believe that e-business technology also can improve organizational knowledge sharing and its diffusion among partner firms in addition to improving knowledge creation.

Even though, existing studies lack empirical support, some practitioners believe that organizational knowledge can be created and shared through e-business technology and can improve supply chain practices that drive competitive performance. For this reason, this study explores the impact of organizational knowledge on supply chain practices and explores the effect of e-business on organizational knowledge creation and sharing. Based on the results, we are able to confirm whether the creation and sharing of organizational knowledge through e-business can effectively improve supply chain practices so as to align for competitive performance. We propose and test a model of the relationship among e-business technology, organizational knowledge, supply chain practices and competitive performances. In this study, we use Structural Equation Modeling (SEM) to test our model.

MATERIALS AND METHODS

The purposes of this study were to investigate (1) the effect of organizational knowledge on supply chain practices and (2) the effect of e-business on organizational knowledge creation and sharing. According to our results, we are able to confirm whether the creation and sharing of organizational knowledge through e-business can effectively improve supply chain practices so as to align for competitive performance.

Research hypotheses: Most scholars and practitioners believe that organizational knowledge can be created, integrated and shared by the cross-platform of information technology. Based on this, researchers started to explore the kinds of information technologies that could be used build a powerful cross-platform in order to aid in organizational knowledge creation. In recent years, some researchers have found that e-business technology can do that. According to Wickramasinghe and Mills (2002), Oppong *et al.* (2005) and Helms *et al.* (2008), through e-business technology, firms can build an effective Business-to-Business (B2B) and Business-to-Customer (B2C) platform, so as to gather and analyze internal and external information. This information may be tacit knowledge from internal human action or external markets and competitors. Through B2B and B2C platforms, firms can effectively gather, integrate and analyze information in order to produce internal and external knowledge. This information can be formed into valuable organizational knowledge. However, knowledge must be diffused among a firm's internal organizations if the firm wants to promote performance through knowledge improvement. Therefore, after organizational knowledge creation, firms must diffuse the knowledge. According to some research studies, e-business technology is able to diffuse organizational knowledge among a firm's internal organizations (Wickramasinghe and Mills, 2002). We believe that e-business technology can improve the creation of organizational knowledge and help with the diffusion of organizational knowledge among supply chain partners. This study will test the following hypothesis:

- **H1:** E-business technology and organizational knowledge are positively related to each other

O'Leary-Kelly and Flores (2002) and Choi *et al.* (2008) indicated that valuable knowledge can be created and applied in a firm's internal organizations and can thus enhance the firm's operations and generate competitive performance. In addition, Hult *et al.* (2006) explored the effects of knowledge on supply chains and found that effective knowledge can influence supply chains and produce competitive performance. Based on other similar research, we infer that the creation and formation of organizational knowledge has positive effects on supply chain practices. This study will test the following hypothesis:

- **H2:** Organizational knowledge has positive effects on supply chain practices (planning, JIT production and delivery practice)

Information flow among partner firms is one of the keys to successful supply chain practice (Albino *et al.*, 2002). To improve information flow, most manufacturers adopt e-business technology in the supply chain. In the past decade, e-business technology has played an important role in information flow and the analysis of supply chains. Through, the application of e-business technology, information is able to effectively flow among

supply chain partner firms and promote partner collaboration (Cagliano *et al*., 2005; Kalakota and Robinson, 1999). In addition to information, we believe that valuable organizational knowledge flow in supply chains is important for the improvement of supply chain practices. Related research indicates that e-business can improve organizational knowledge to diffuse it in a supply chain operational environment so as to improve supply chain practice (Shevchenko and Shevchenko, 2005). We believe that e-business can improve organizational knowledge in the supply chain operational environment to improve its practice. However, the key is that the e-business must influence supply chain practice. This study will test the following hypothesis:

- **H3:** E-business technology has a positive effect on supply chain practice

In this study, supply chain practices can be divided into three categories: supply chain planning, Just-In-Time (JIT) production and delivery practices. According to Comelli *et al*. (2008) and the Supply Chain Council (2000), effective supply chain planning with on-demand forecasting can improve supply chain practices resulting in highly competitive performance. In JIT production, supply chains align performance with effective practices in the supply chain operational environment. In the delivery practice, supply chain operational environments can improve supply chain practice results (Zhou and Benton, 2007). Based on the above, we know that supply chains can effectively align with highly competitive performance. Therefore, this study will test the following hypothesis:

- **H4:** Supply chain practice has a positive effect on competitive performance

Research framework: According to our study purposes and hypotheses, we can build a research framework such as the one represented in Fig. 1. We found that e-business may have a positive effect on knowledge creation and knowledge sharing as well as supply chain practice. Through e-business, organizational knowledge can effectively improve supply chain practice so as to align the supply chain for highly competitive performance. Therefore, this study considers the effect of e-business on knowledge creation and sharing; we also link organizational knowledge and supply chain practice to build a complete research framework. Based on the above, our research framework is, first, formally to investigate the relationship among e-business, organizational knowledge creation and sharing, supply chain practice and competitive performance.

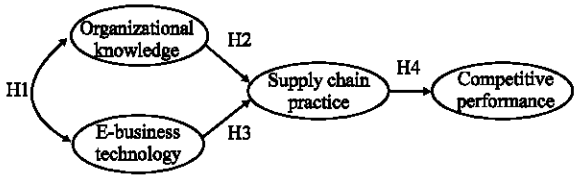

Fig. 1: Research framework

Sampling and conducting: The purposes of this study are to investigate (1) the effect of organizational knowledge on supply chain practice and (2) the effect of e-business on organizational knowledge creation and sharing. According to our results, we can confirm whether or not the creation and sharing of organizational knowledge through e-business can effectively improve supply chain practice so as to align for competitive performance. Present investigations were conducted in Taiwan from February 2009 to April 2009. In this study, we adopt the survey results of a questionnaire from the International Manufacturing Strategy Survey (IMSS) database in order to analyze our research framework. The IMSS is an international cooperative research network that explores issues related to manufacturing strategy research, supply chains and e-business. The total responses included 711 firms in 23 different countries. Taiwan joined the IMSS project in 2006, providing another 50 samples to the IMSS, which increased the total number of samples to 761. In this study, we discarded 209 incomplete samples. Thus, only 552 out of 761 total responses were used for our data analysis in this study.

Regarding the profile of this sample, 39 samples are from manufacturers in Argentina; 8 are from manufacturers in Australia; 25 are from manufacturers in Belgium; 12 are from manufacturers in Brazil; 17 are from manufacturers in Canada; 27 are from manufacturers in China; 24 are from manufacturers in Denmark; 15 are from manufacturers in Estonia; 14 are from manufacturers in Germany; sever are from manufacturers in Greece; 46 are from manufacturers in Hungary; 8 are from manufacturers in Ireland; 12 are from manufacturers in Israel; 27 are from manufacturers in Italy; 21 are from manufacturers in New Zealand; 45 are from manufacturers in the Netherlands; 12 are from manufacturers in Norway; eight are from manufacturers in Portugal; 45 are from manufacturers in Sweden; 33 are from manufacturers in Turkey; 12 are from manufacturers in the United Kingdom; 26 are from manufacturers in the USA; 25 are from manufacturers in Venezuela; 44 are from manufacturers in Taiwan. The average number of employees in the sampled firms is 18,872.

Table 1: Measures underlying the constructs

Variables	Factors
E-business technology	
EB1	Scouting/pre-qualify
EB2	Auctions
EB3	RFx (request for quotation, proposal, information)
EB4	Data analysis (audit and reporting)
EB5	Access to catalogues
EB6	Order management and tracking
EB7	Content and knowledge management
EB8	Collaboration support services
Knowledge creation and sharing	
KW1	Inventory level knowledge with supplier/customer
KW2	Production planning decisions and demand forecast knowledge with supplier/customer
Supply chain practice	
SP1	Order tracking/tracing (JIT)
SP2	Agreements on delivery frequency (Delivery practice)
SP3	Dedicated capacity (JIT)
SP4	You manage or hold inventories of materials at your supplier/customers' site(s) (e.g., Vendor Managed Inventory, Consignment Stock) (JIT)
SP5	Collaborative Planning, Forecasting and Replenishment (Planning)
SP6	Physical integration of the supplier/customer into the plant (JIT)
Competitive performances	
CP1	Cost
CP2	Quality
CP3	Delivery
CP4	Flexibility

Measurements: The measurements underlying the constructs in Table 1 are based on the questionnaire from the International Manufacturing Strategy Survey (IMSS), which is designed by researchers from 23 countries. Based on the measurements underlying the constructs in Table 1 is from IMSS, we found the status or application of e-business technologies, organizational knowledge, supply chain practice and competitive performance can effectively be surveyed so as to obtain data from global manufacturers.

In the questionnaire, a five-point Likert scale was used. On a five-point scale of e-business, a score of one meant no adoption and a score of five meant is high adoption. On a five-point scale of organizational knowledge, a score of one meant no adoption and a score of five meant high adoption. On the five-point scale for supply chain practice, a score of one meant no adoption and a score of five meant high adoption. On the five-point scale for competitive performance, a score of one meant deteriorated more than 10% and a score of five meant improved by more than 50%.

Research methodology: Structure Equation Modeling (SEM) was used to test our hypotheses. SEM is a very general and powerful statistical modeling technique. Effective using SEM, path analysis and regression analysis, relevant variables can be accurately explored. Therefore, researchers are likely to use SEM to determine whether a certain model is valid and suitable to verify research hypotheses. In the conducting step, psychological researchers and the American Psychological Association (APA) recommended a two-step approach for conducting SEM. First, according to our research framework and measurement constructs (Table 1), we used Confirmatory Factory Analysis (CFA) to measure the acceptability of our research framework. Therefore, in the first stage, latent factors were identified (such as e-business technology, knowledge creation and sharing, supply chain practice and competitive performance) and the relationship among the observed variables (such as EB1, EB2 …) and their respective latent factors were tested. The fit index is then observed to ensure that the research framework is acceptable. Second, we used EQS to measure the model. The results of these measurements relate to model fit and our research hypotheses.

Validity and reliability: After taking samples and obtaining data, based on our research framework, we tested the validity and reliability for these constructs. Since, abnormality would influence our results, we tested for normality by using the Skewness Test and the Kurtosis Test before testing for construct validity and reliability. The result of the Skewness and Kurtosis tests showed that the Auctions (EB2) (regarding e-business) did not exhibit a normal distribution. Therefore, the Auctions variable was removed from the analysis.

Confirmatory Factor Analysis (CFA) was used to verify the validity of the constructs and Cronbach's alpha coefficients were used to verify the reliability of the constructs. CFA and Cronbach's alpha can measure the acceptability of a research framework. According to the CFA results from Table 2, we found that all the t-test coefficients are significant at the level of 0.01 and all

Table 2: Results of CFA and reliability

Variables	Factors	loadingq	Cronbach's alpha	t-test
E-business technology				
EB1	Scouting/pre-qualify	0.611		0.000**
EB3	RFx (request for quotation, proposal, information)	0.551		0.000**
EB4	Data analysis (audit and reporting)	0.782		0.000**
EB5	Access to catalogues	0.563	0.896	0.000**
EB6	Order management and tracking	0.790		0.000**
EB7	Content and knowledge management	0.885		0.000**
EB8	Collaboration support services	0.865		0.000**
Knowledge creation and sharing				0.000**
KW1	Inventory level knowledge with supplier/customer	0.817		0.000**
KW2	Production planning decisions and demand forecast knowledge with supplier/customer	0.702	0.728	0.000**
Supply chain practice				0.000**
SP1	Order tracking/tracing (JIT)	0.656		0.000**
SP2	Agreements on delivery frequency (Delivery practice)	0.565		0.000**
SP3	Dedicated capacity (JIT)	0.731		0.000**
SP4	You manage or hold inventories of materials at your supplier/customers' site(s) (e.g., Vendor Managed Inventory, Consignment Stock) (JIT)	0.736	0.842	0.000**
SP5	Collaborative Planning, Forecasting and Replenishment (Planning)	0.758		0.000**
SP6	Physical integration of the supplier/customer into the plant (JIT)	0.734		0.000**
Competitive performances				0.000**
CP1	Cost	0.818		0.000**
CP2	Quality	0.787	0.881	0.000**
CP3	Delivery	0.863		0.000**
CP4	Flexibility	0.763		0.000**

**Significant at p<0.01; *Significant at p<0.05

factors were loading between 0.534 and 0.860. These results mean the construct validity is acceptable. The Cronbach's alpha coefficients for the items under individual constructs were much larger than the threshold value of 0.7, meaning that the results from Cronbach's alpha coefficients are better. In addition to validity and reliability, CFA has shown that the indices including CMIN/df (449.542/132), RMR (0.047), RMSEA (0.066), GFI (0.920), CFI (0.944) fit well.

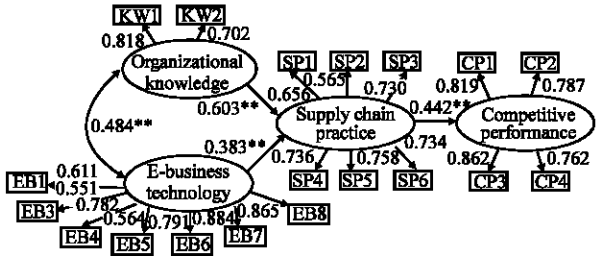

Fig. 2: Result of SEM

RESULTS

After CFA, SEM was used to analyze our research framework and hypotheses. All related indices were acceptable, including CMIN/df (450.830/134), the Goodness of Fit Index (0.920), the Root Mean Square Residual (0.047), the Incremental Fit Index (0.945), the Tucker Lewis Index (0.929), the Comparative Fit Index (0.944) and the Root Mean Square Error of Approximation (0.066). All of the indices together suggest that the data fit the hypothesized model reasonably well. Regarding hypothesis testing, all hypotheses were supported according to the F-tests, as seen in Fig. 2. In Fig. 2, we find the path coefficient of hypothesis 1 to be equal to 0.484 (p<0.01). According to our results, this hypothesis is therefore confirmed. This means that e-business technology and organizational knowledge are positively related to each other. Figure 2 also shows that the second and third hypotheses are confirmed. According to our results, the path coefficient of hypothesis 2 is equal to 0.603 (p<0.01) and the path coefficient of hypothesis 3 is equal to 0.383 (p<0.01). The results for hypotheses 2 and 3 proved that organizational knowledge and e-business technology have a positive effect on supply chain practice. Finally, Fig. 2 also shows that the path coefficient of hypothesis 4, path coefficient of hypothesis 4 is equal to 0.442 (p<0.01) and therefore, Hypothesis 4 is confirmed. This means that supply chain practices have a positive effect on competitive performance.

DISCUSSION

According to our statistical test results for the hypotheses, we can assert the following. Hypothesis 1 states that e-business technology and organizational knowledge are positively related to each other. The path coefficient for hypothesis 1 is equal to 0.484 (p<0.01). According to the test results, the first hypothesis is therefore confirmed. The results also support hypotheses 2 and 3. Hypothesis 2 states that organizational knowledge has a positive effect on supply chain practices

(such as planning, JIT production and delivery practices). The path coefficient is equal to 0.603 ($p<0.01$). Hypothesis 3 states that e-business technology has a positive effect on supply chain practices and that the path coefficient is equal to 0.383 ($p<0.01$). Therefore, the second and third hypotheses are confirmed. Finally, hypothesis 4 states that supply chain practices have a positive effect on competitive performance; the path coefficient (coefficient=0.442, $p<0.01$) confirms this hypothesis. By implementing an SEM approach, this study integrates four constructs: organizational knowledge, e-business technology, supply chain practice and competitive performance.

The purposes of this study are to investigate (1) the effect of organizational knowledge on supply chain practice and (2) the effect of e-business on organizational knowledge creation and sharing. According to our results, we can confirm whether or not the creation and sharing of organizational knowledge through e-business can effectively improve supply chain practices so as to align for competitive performance. To our knowledge, this is the first study to formally investigate the relationship among e-business, organizational knowledge creation and sharing, supply chain practices and competitive performance. Our findings indicate that organizational knowledge has an effect on the current supply chain operational environment. The results show that organizational knowledge is a key input for supply chain practices leading to a competitive performance that will create a powerful advantage. This result addresses the first research purpose (the effect of organizational knowledge on supply chain practice). In fact, current competitive environments have shown that market demand is unpredictable. Obtaining a competitive advantage in a dynamic environment and improving effective supply chain practices in order to respond immediately to demand is the critical point. However, manufacturers with partner firms must have a powerful knowledge base in order to achieve best practices in supply chain management when they face a variety of demands under dynamic environments. Therefore, the creation of valuable organizational knowledge plays an important role in supply chain practice. In fact, the creation of organizational knowledge is a result of internal and external information and related experience. Therefore, manufacturers with partner firms can effectively collaborate and create the best JIT production and delivery practices in order to form a supply chain that responds to a variety of demands in a dynamic environment. This finding is consistent with research by Hult *et al.* (2006), Ke and Wei (2007), Paulraj *et al.* (2008) and Samaddar *et al.* (2006).

However, a key question is how one creates organizational knowledge. According to our findings, e-business technology can promote organizational knowledge creation. According to our literature review, the creation of organizational knowledge depends on the information gathering and analytical process. Through, e-business technology, firms can build a Web-based platform to gather and analyze information, experience, or tacit knowledge from human action in an internal and in an external environment. Through analysis, valuable organizational knowledge can be created. This finding is consistent with research by Helms *et al.* (2008), Chang *et al.* (2004) and Cegarra-Navarro *et al.* (2007), which indicated that e-business technology has a positive impact on organizational knowledge creation. However, organizational knowledge must be shared and diffused between partner firms in order to improve their supply chain practices. According to our research, e-business technology can also be used as a means for sharing organizational knowledge. E-business is a Web-enabled platform for gathering and analyzing information. Scott (1998), Newell and Huang (2004) and Helms *et al.* (2008) further confirm that e-business technology can share and diffuse organizational knowledge. This point is also confirmed by our results and it addresses our second research purpose (the effect of e-business on organizational knowledge creation and sharing).

Based on the above, we can confirm that the creation of organizational knowledge through e-business allows for the rapid sharing and diffusion of organizational knowledge to supply chain partners and can effectively improve supply chain practices so as to align for competitive performance. The main theoretical contribution of this study is to confirm the effect of e-business technology on organizational knowledge creation and sharing in a supply chain operational environment. Based on e-business, manufacturers can effectively create valuable knowledge and share it with partner firms so as to ensure successful supply chain practices. In fact, researchers believe that organizational knowledge can improve supply chain practice; however, how to create and share organizational knowledge in the supply chain operational environment is an important question. Although some practitioners believe that organizational knowledge can be created and shared through e-business technology and can improve supply chain practices to drive competitive performance, existing studies lack empirical support. Therefore, our research results differ from previous studies and provide a new concept for supply chain research.

CONCLUSIONS

Supply chains must use effective practices if a manufacturer wants to achieve competitive advantage. In fact, many manufacturers believe that the creation and sharing of organization knowledge can improve supply chain practice. However, how to create and share organizational knowledge is an important question. The purposes of this study are to investigate (1) the effect of organizational knowledge on supply chain practices and (2) the effect of e-business technology on organizational knowledge creation and sharing. According to our results, organizational knowledge can effectively improve supply chain practices and lead to greater competitiveness. In fact, organizational knowledge is from analysis result of past experience and information. Therefore, manufacturers and partner firms can immediately decide on the best form of collaboration based on organizational knowledge and can effectively respond to market requirements. Otherwise, organizational knowledge can be created by promoting e-business. Organizational knowledge is from analysis result of past experience and information, e-business can effectively collect and analyze related experience and information according the literatures. Therefore, e-business also plays a role in organizational knowledge by improving and diffusing knowledge in a supply chain operational environment, thereby improving supply chain practices.

The abovementioned results have important implications for academic research and the industry as a whole. Regarding academic research, the results of this study show that organizational knowledge has a positive effect on supply chain practices. Therefore, in addition to the resource-based and coordination viewpoints, issues of organizational knowledge are indispensible in the supply chain context. In the industry, supply chain managers should highlight the importance of organizational knowledge. They should also consider using e-business technology to assist in organizational knowledge creation, applying it to supply chain operational environments with the effect of improving supply chain practices.

Nevertheless, this study has some limitations. Therefore, we encourage further research that explores these limitations. First, according to the results of this study, we did not develop or explore a case that formulates valuable knowledge through e-business. Future researchers may thus use this study to carry out further studies. Second, we did not discuss how organizational knowledge influences the three operations of supply chain practices (supply chain planning, JIT production and delivery practice). Hence, since these issues are not addressed in this study, they should be discussed in future research.

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