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SUPPLY CHAIN MANAGEMENT PRACTICES AND SUPPLY CHAIN PERFORMANCE IN THE AUSTRALIAN MANUFACTURING INDUSTRY

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Abstract

Supply chain management (SCM) is identified as a strategic tool for firms to improve their performance and secure their competitiveness. This research identifies five aspects of SCM practice: supplier and customer relations, internal operations, information sharing, information technology (IT) and training. The survey in the Australian manufacturing industry was conducted to study the extent to which SCM practices were implemented. It examined the relationship between SCM practices and firms' performance. The results show that SCM practices differentiate firms with low and high level of performance. The results specifically highlight the contribution of IT and information sharing to firms' operational performance. Also, the study found that training significantly contributes to most performance measures.

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INTRODUCTION

Today the new source of business competition lies outside the walls of organizations, and is determined by how effectively companies link their operations with their supply chain partners such as suppliers, distributors, wholesalers, retailers and end customers. SCM offers a management philosophy to manage activities and integrate with downstream and upstream partners as well as firms' internal supply chain (Ross, 1998). The objective of SCM is not only related to improving the performance of an individual company, but also of the whole supply chain (Mentzer et al., 2001).

Mentzer et al. (2001, p. 4) define supply chain as "a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer". They further identify three types of supply chain based on the degree of complexity: a direct supply chain, extended supply chain, and ultimate supply chain. The direct supply chain consists of a focal firm, its suppliers and its customers. The extended supply chain involves supplier's suppliers and customers' customers. The ultimate supply chain includes all organizations that are involved in all flows of products, services, finance, and information from the ultimate suppliers to the ultimate customers.

From the point of view of Ayers (2001), supply chain is knowledge movement that includes all activities related to the back flow of product from customers back up to the chain in the form of product return, reuse, and recycling.

Ayers' definition suggests that every single company depends on other businesses to deliver its products or services to its customers. Any organization can be a member of more than one supply chain and its position in each supply chain can vary. In one supply chain, a company can be a components supplier, but in the other it can be an assembly manufacturer (Mentzer et al., 2001). Given this complexity of supply chain that a company can be involved with, Lambert et al. (1998) suggest that each company evaluates which business partners are critical to its performance.

Literature shows many definitions of SCM (Handfield and Nichols, 1999; Cooper et al. 1997; Menzter et al., 2001) that suggest several points. First SCM views a supply chain as a single entity, it requires cross functional integration within an organization and across companies within the supply chain. Second, SCM aims to improve the performance of individual companies as well as that of the whole supply chain. SCM does not allow a company to achieve improvement at the expense of other companies. It emphasises that companies should compete on the basis of the whole supply chain, competing against other supply chains. Third, companies should build and maintain the following management practices: integrated behaviours, mutually sharing of information, mutually sharing of risks and rewards, cooperation, the same goal and the same focus on serving customers, integration of processes, and building and maintaining long-term relationships.

Previous studies reported that the effective implementation of SCM contribute to organizational performance. For example, Tan et al. (1998) empirically found that customer relations and purchasing practices impact the effectiveness of SCM strategy and lead to financial and market performance. Frohlich and Westbrook (2001) studied the impact of supplier and customer integration to company's performance. They identified five different integration strategies: inward-facing, periphery-facing, supplier-facing, customer-facing, and outward facing. These strategies represent the various degrees of integration with suppliers and customers. They found that companies with broader supply chain integration – with customers and suppliers – showed the largest performance improvement. Vickery *et al.* (2003) found that the relationship between supply chain integration with financial performance was indirect and fully mediated by customer service performance. Recently, Li et al. (2006) studied the impact of SCM practices on organizational

performance and competitive advantage. They found that SCM practices as a multidimensional concept cover upstream and downstream supply chain as well as internal supply chain. Li et al (2006) study showed significant impact of SCM practices to organizational performance and competitive advantage.

Li et al.'s (2006) work is the only one amongst the published literature that captures almost the whole concept of supply chain as it covers downstream and upstream side of supply chain and internal business processes. Others only cover some parts of supply chain concepts (Tan et al., 1998; Frohlich and Westbrook, 2001).

The purpose of this paper is first, to study the extent to which the Australian manufacturing industry implements SCM management practices; and second, to analyse how the SCM practices contribute to improving organizational performance.

The rest of this paper is structured as follows. The following section discusses the underlying theory of each SCM practices. The research methodology is then presented, followed by the discussion of the respondent profile on each dimension of SCM practices as well as the statistical analysis examining the relationship between SCM practices and performance.

RESEARCH CONSTRUCTS

The extant literature shows many different perspectives of SCM practices (Tan *et al.*, 1998, 2002; Kopczak and Johnson, 2003; Chen and Paulraj, 2004; Li *et al,* 2005). Those various perspectives suggest a multi-dimensionality of SCM that covers set of activities and processes from upstream and downstream and firm's internal operations. This is in line with Ballou *et al.* (2000) that conceptualise SCM as three dimensions: intra-functional coordination, inter-functional coordination, and inter-organizational coordination. This research uses five aspects of SCM practices that were developed from previous research including Perry and Sohal (2000) and Petrovic-Lazarevic *et al.* (2007). These five SCM practices are: supplier and customer relationship, information sharing, internal operation, IT and training. The rest of this section provides the detail explanation of these practices.

Supplier and Customer Relationship

Supplier and customer relationship is defined as a set of firms' activities in managing its relationships with customers and suppliers to improve customer satisfaction and synchronize supply chain activities with suppliers, leverage suppliers' capability to deliver superior products to customers. SCM suggests that firms need to integrate with their suppliers and customers to achieve financial and growth objectives (Tan, 2001). Stank *et al.* (2001) reveal that industry leaders increasingly build competencies to integrate with suppliers and customers and find that these competencies lead them to supply chain excellence. Supplier involvement in product development allows firms to make better use of their suppliers' capabilities and technology to deliver competitive products (Handfield *et a*l., 1999). Coordinating operational activities through joint planning with suppliers also results in inventory reduction, smoothing production, improve product quality, and lead time reductions (Ansari *et al.*, 1999). Lee (2002) argues that integration with suppliers throughout the product life cycle is an effective strategy in reducing supply uncertainty.

The ultimate objective of SCM is to deliver products to the satisfaction of end customers. Customer relevancy then becomes a key strategic commitment of leading corporations (Bowersox *et al.*, 2000). Close customer relationship allows companies to be more responsive in fulfilling customers' demand and improving customer satisfaction by proactively seeking customers' needs and requirements. The ability to build close relationship with customers will bring companies into a lasting competitive edge (Bowersox *et al*., 1999).

Internal Operations

In addition to upstream and downstream integration, SCM also emphasizes the importance of both effectiveness and efficiency of firm's internal operations on its performance (Handfield and Nichols, 1999). A company's internal operations are the basis for developing a competitive advantage before embarking into external integrations. Poor internal operations can lead to failure in coordinating with external partners.

In this research, internal operations refer to all activities related to production systems and internal logistic flows. SCM requires flexibility in the production system in order to respond to market changes. This means that a production system must be able to perform rapid changeover in both order pattern and mass customization (Lambert and Cooper, 2000). Power and Sohal (2001) find that technology utilisation, continuous improvement and computer-based automation in manufacturing are some of the characteristics of agile organisations. In studying quick response program, Perry and Sohal (2000) reveal that order automation and factory automation are some of the key enablers to realize the benefits of quick response program.

Information Sharing

Information sharing is an important aspect in achieving seamless integration in a supply chain (Lee, 2000). Cross functional integration and inter organizational integration require the visibility of information across the supply chain. Poor information sharing between partners in a supply chain will result in poor coordination that will lead to many serious problems such as high inventory levels, inaccurate forecast, low utilization, and high production costs (Lee and Whang, 2000). Indeed, information sharing is highly considered as the way to reduce demand uncertainty (Lee, 2002).

Many studies have reported that information sharing can bring many benefits both to suppliers and buyers, such as inventory reduction, and reduced manufacturing costs (Huang and Gangopadhyay, 2004; Raghunatahan, 2003; Småros *et al.*, 2003; Yu *et al.*, 2001). The empirical findings from Narasimhan and Nair (2005) reveal that information sharing can increase the operational synergy amongst supply chain partners.

The type of shared information can vary from strategic to operational information and from consumer and market information to logistics information (Huang *et al.,* 2003). The impact of information sharing on SCM depends on what information is shared, quality on shared information, and companies' capability in using and translating the information into a supply chain strategy and operational activities (Lee and Whang, 2000; Moberg *et al.*, 2002).

IT

The effective use of IT provides companies with competitive advantage (Porter and Millar, 1985). In SCM, IT is highly regarded as a major enabler in achieving effective SCM. As a supply chain spans many organizations in delivering products to customers both upstream and downstream and many functional areas within a company, the implementation of IT allows companies to increase communication and coordination of various value adding activities with their partners and between functions within their own operations (Simchi-Levi *et al.*, 2000). In addition, advance development of the Internet technology offers significant opportunities for cost reduction, increasing flexibility, increasing response time, and improving customer services (Lancioni *et al.*, 2000; Lee and Whang, 2001).

The extant literature shows the role of IT as an enabler in effective SCM. William *et al.* (1997) find IT as a strong predictor for logistics integration. Other studies warn that the benefit of IT in SCM do not come from the capabilities of IT itself, instead the significant benefits come from the combination of its application with corporate strategy and the nature of relationship between companies. Sanders and Premus (2002) empirically found that IT provides significant contribution

to organizations' performance and competitive advantage when it is well linked with firms' competitive priorities. Through case study research, Chae *et al.* (2005) found that the impact of IT in supply chain collaboration depends on the existing nature of relationship between partners. IT will improve collaboration and coordination between supply chain members in the environment where trust and long-term commitment between partners exist.

Training

The major concept of SCM is collaboration and seamless integration between various value adding activities within individual companies and across different organizations along a supply chain. Bringing this concept into practice requires significant changes in corporate culture as well as a new level of human performance. Successful implementation of SCM concept largely depends on human assets of organizations (Bowersox *et al.*, 2000; Mentzer, 2004). Past behaviour such as functional silo thinking will undoubtedly impede the effectiveness of SCM. Therefore, Gattorna (2006) asserts managing supply chain actually involves the interaction between human behaviour, IT, and infrastructure.

Effective SCM requires managers to have an understanding of supply chain dynamic and an ability to use information based tools. Lee and Whang (2000) contend that information visibility through out a supply chain will not bring significant impact if companies do not have capabilities to utilize the information in effective ways. Hence, companies need to consider the skills requirements and education when integrating their value-adding activities with their partners (Gattorna and Clark, 2003). Effective training and knowledge based learning is essential in developing and maintaining these new SCM skills. However, there is no previous study that includes training as a part of SCM practices and tests its relationship with performance.

SURVEY METHODOLOGY

Based on the constructs described above, a questionnaire was designed to collect information on how randomly selected Australian manufacturing companies from the official list of companies implement those practices. A set of questions on each practice was derived from the literature as well as from authors' previous research projects: SCM initiative at the Australian textile, clothing and footwear industry and a cereal food supply chain project (Perry and Sohal, 2000; Petrovic-Lazarevic *et al.*, 2007). In addition, several demographic questions were also included in the questionnaire to gain insights of the respondent's operations.

The survey instrument was mailed to 1,000 senior executives responsible for SCM in Australian manufacturing companies. The mail survey yielded a total of 64 usable responses (response rate of 6.4%). The low response rate occurred probably as a common case in organizational-level survey (Li *et al.*, 2006) caused by senior executives' many requests to participate in surveys. In addition, the fact that the survey instrument covers a broad range of areas may contribute to the low response rate too. As a consequence; the low response rate of this study affects the ability to generalize the results.

Table 1 provides the respondents' profile. In terms of the number of employee, 66.1% of the companies employed fewer than 100 employees while 16% of the companies employed between 101-300 employees. The industry sectors represented in the sample varied with majority from machinery and equipments manufacturing (20.3%), chemical manufacturing (15.6%), and food manufacturing (10.9%).

RESULTS

Profile of Supply Chain Management Practices

Supplier and Customer Relationship

Table 2 provides the progress of surveyed firms on their supplier and customer relationship practices. Responses were provided on a Likert scale ranging from 1 to 5, where 1 was the worst and 5 the best responding. Respondents reported that their major customers are getting stricter on delivery requirements (mean 4.09) and 71.9% of surveyed firms perceived that their major customers are on the high level of delivery adherence requirements. Respondents reported that their firms' ability to satisfy strict delivery requirement are quite high and their level of compliance with respect to "delivery in-full" and "on-time" requirements are 4.02 and 3.95 respectively. In term of the cooperation with major customers, the level of cooperativeness in relationship with major customers has a mean of 3.95 with 71.9% of firms reporting high and very high level of cooperativeness. However, the level of joint product planning with customers is very low (mean 2.83) with only 33.4% of firms who experience high and very high level of joint product planning with their major customers.

Table 1: Demographics data for the respondents

Variables	Frequency	Percent
Number of employees (n=62)		
50 – 100	41	66.1
101 – 300	10	16.1
301 – 500	3	4.8
501 – 1000	7	11.3
Over 1000	1	1.6
Industry Sector (n=64)		
Food Manufacturing	7	10.9
Textile Manufacturing	4	6.3
Paper and printing manufacturing	5	7.8
Chemical Manufacturing	10	15.6
Metal product Manufacturing	16	25
Machinery and equipments	13	20.3
Automotive Industry	4	6.3
Others	5	7.8

Table 2: Supplier and Customer Relationship

Variables	Mean	s.d	%
The strictness of major customer's delivery adherence requirements	4.09	0.886	71.9
Level of compliance with major customer's delivery in-full requirements	4.02	1.061	71.9
Level of compliance with major customer's delivery on time requirements	3.95	1.122	67.7
The level of cooperativeness in your relationship with major customer	3.95	0.916	71.9
The level of joint product planning with major customers	2.83	1.199	33.4
The level of cooperativeness in relationship with major suppliers	3.75	0.879	68.3
The level of joint product planning with major suppliers	2.97	1.164	37.9
Occurrence of meeting with customers and suppliers	1.81	1.162	11.1

***%** the percentage of respondents with response value of 4 and 5*

In regard to relationship with suppliers, the level of cooperativeness with major suppliers has a mean of 3.75, although there are 68.3% of firms who reported a high or a very high level of cooperativeness. In term of involving major suppliers into product planning, the surveyed firms rated this practice at low level with only 37.9% of firms who reported to have high or very high level of supplier involvement in product planning.

Internal operations

The survey results on the internal operations practices are shown in Table 3. More than half of surveyed firms indicated the 'up-to-datedness' of their production system as above average. However, in term of automation of production processes, only 36.5% of surveyed firm reported that their production processes were highly automated. Slightly fewer than half of the respondents reported the extensive adoption of continuous improvement program (mean 3.38). A large proportion of respondents perceived that the continuous improvement adoption still needs more attention. The management support on the supply chain effectiveness was reported at a low level. In terms of the level of management understanding in promoting supply chain effectiveness, only 39.1% of surveyed firms rated this to be excellent (mean 3.27). The lowest level of implementation was reported for modular production (mean 2.9) with only 33.3% of respondents indicating this to be extensive. This might be the case since implementation of modular production depends on the product and market characteristics and may not be suitable for all situations (Fisher, 1997; Li et al., 2006).

Table 3: Internal Operations Practices

Variable	Mean	s.d	%
Up-to-datedness of production	3.73	0.947	63.1
Internal logistics flow for main product	3.56	0.736	57.1
Flexibility of production system to handle order pattern	3.56	0.99	56.2
The extent of innovation occurring in relation to the main product	3.48	0.908	54.7
The extent of continuous improvement adoption	3.38	0.724	43.7
Management know-how regarding supply chain effectiveness	3.27	0.718	39.1
The extent of production process automation for main product	3.19	1.075	36.5
The extent of modular production	2.9	1.145	33.3

***%** the percentage of respondents with response value of 4 and 5*

Information Sharing

The extent of information sharing along the supply chain is shown in Table 4. The sharing of forecast information with suppliers was reported at the mean level of 3.31 with only 46.9% of surveyed firm rating this at high and very high level. In terms of forecast information received from customers, 68.3% of respondents reported this at the high level with an overall mean score of 3.75. Only 33.8% of surveyed firm received forecast information from their customers at the mean level of 2.92. Information sharing on other product related data with suppliers and customers along the supply chain was reported at quite low level (mean 2.84). There is only 38.1% of respondent and 31.2% of respondents who share non forecast information with suppliers and customers respectively.

Table 4: Information Sharing Practices

Variable	Mean	s.d	%
Satisfaction with forecast information sharing from customers	3.75	0.879	68.3
Forecast information sharing with major suppliers	3.31	1.006	46.9
Other product related information sharing with suppliers	3.29	0.906	38.1
Other product related information sharing by customers	3.13	0.9	31.2
Forecast information sharing by customers	2.92	1.145	33.8
Adequacy of information flow throughout supply chain	2.84	1.042	28.1
Overall efforts to provide sales forecast data along supply chain	2.71	1.128	27

***%** the percentage of respondents with response value of 4 and 5*

IT

In regard to IT, the respondents reported that the level of IT implementation was considerably low (see Table 5). The implementation of automated ordering with supplier and customer were reported at the mean of 2.98 and 2.57 respectively. From all of respondents, there are no more than 37.5% of them who reported to have high and well established implementation of automated ordering. In addition, the survey reported that the firms that perceived the adequacy of as well as the up-to-datedness of IT throughout the supply chain were significantly low with mean level at 2.86 and 2.91 respectively.

As IT is an enabler for supply chain effectiveness and improving operations performance, the results indicate that respondent companies need to invest more time and effort on IT implementation in order to improve the accuracy and speed of order processing.

Training

The findings from the survey relating to training practices are presented in Table 6. The overall level of production employee skills was reported at mean level of 3.59; whilst the adequacy of production training was reported at mean level of 3.62. Less than 60% of the surveyed firms perceived the adequacy of production employee training to be at the high level. However, in term of supply chain related training, the survey reported that firms perceived poor implementation (with mean level of 2.78 on supply chain effectiveness and 2.56 on supply chain technologies).

Table 5: IT

Variable	Mean	s.d	%
The level of IT-based automated ordering from major customers	2.98	1.485	37.5
The level of IT-based automated ordering to major suppliers	2.57	1.399	30.2
The up-to-datedness of IT technologies throughout the supply chain	2.91	1.035	26.4
The adequacy of IT systems throughout the supply chain	2.86	0.99	25

***%** the percentage of respondents with response value of 4 and 5*

Table 6: Training Practices

Variable	Mean	s.d	%
The overall level of production employee skills	3.59	0.921	56.2
The overall adequacy of production employee training for the job	3.62	0.831	58.7
The extent of management training to do with increased supply chain effectiveness	2.78	0.951	21.9
The extent of employee training in supply chain technologies	2.56	0.889	10.9

***%** the percentage of respondents with response value of 4 and 5*

Impact of SCM Practices on Performance

To investigate the impact of SCM practices on performance, each performance measure was compared between respondents with high level and low level of SCM practices using independent-sample t-test. Prior to t-test analysis, respondents were divided according to their level of SCM practices. The cut-off value of three was chosen to differentiate between low and high level of SCM practices. Eta squared of each test was calculated to measure the effect size of each mean different (Pallant, 2004). Table 7 presents mean difference between high and low level of SCM practices of each performance indicator.

Lead Time Minimisation. Table 7 shows that there were significant differences in the mean lead-time minimisation performance between low and high level of all SCM practices. The highest significant level was training, followed by IT, information sharing, internal practices, and supplier and customer relationship. The training practice explained 12.2% of variance in lead time minimisation performance, significant at the 0.01 level. Information sharing and IT explained 8.7%

and 6.5% of variance in lead-time minimisation respectively, both significant at $p < 0.05$. Internal operation and customer and supplier relationship were significant at $p < 0.1$ and explained only 4.6% and 3.3% of variance in lead-time minimisation.

Lead-time typically comprises of two components: order lead-time (required time to produce and ship a product) and information lead-time (required time to process an order) (Simchi-Levi *et al.*, 2003). It appeared that training practices facilitate the improvement of lead-time performance. Increasing skills of employees in production and SCM would improve operational efficiency and the effectiveness of planning processes. Operational efficiency will lead to reduction in order lead-time while increased SCM planning effectiveness will increase the speed of order processing.

Information sharing helps companies to cut lead-time by increasing their forecast accuracy, efficient flow of information throughout the supply chain and improve the effectiveness of the management of inventory and production planning process. Information sharing is highly enabled by IT that also influences lead-time through better order processing. Previous research by Cachon and Fisher (2000) confirms this finding, in which they conclude that advances in IT, can significantly reduce lead-time. Internal operations influence lead-time minimisation through improved manufacturing lead-time due to efficient production and internal logistics flow.

Supplier and customer relationship - which is facilitated by IT and information sharing - enables better supply chain coordination which in turn leads to reduced variability including lead-time. These findings are in line with Frohlich and Westbrook (2001) who found that higher degree of information sharing and close relationship with suppliers and customers can reduce manufacturing, delivery, and procurement lead-times.

Table 7: T-test analysis of each performance

SCM Practices	Mean Differences					
	Lead Time Minimisation	Inventory Turnover	Avoidance of product reject/ return	Level of Sales	Cost Reduction	Effectiveness in meeting customers' requirement
Supplier and customer relationship	-0.526*	-0.619**	-0.359	-0.078	-0.337	-0.467**
	(0.033)	(0.045)				(0.094)
Internal operations	-0.536*	0.768***	-0.232	-0.304	-0.696***	-0.250
	(0.046)	(0.16)			(0.14)	
Information sharing	-0.484**	-0.496*	-0.552**	-0.409*	-0.671***	-0.548***
	(0.087)	(0.054)	(0.089)	(0.055)	(0.167)	(0.141)
IT	-0.416**	-0.693***	-0.363	-0.359*	-0.595***	-0.057
	(0.065)	(0.107)		(0.045)	(0.132)	
Training	-0.633***	-0.432	-0.514**	-0.370	-0.519**	-0.208
	(0.122)		(0.067)		(0.081)	

**** Significant at p <0.01 ** Significant at p <0.05 * Significant at p < 0.10*
Numbers in the parentheses are Eta square values

Inventory Turnover. IT, internal operations, customer and supplier relationship and information sharing significantly influenced inventory turnover performance. The analysis reveals that 16% of variance in the level of inventory turnover was explained by internal operations practice with the

significant level of 0.01. IT explained 10.7% of variance in inventory turnover and significant at $p < 0.01$. Supplier and customer relationship was significant at $p < 0.05$ and explained 4.5% of variance in inventory turnover while 5.4% is contributed by information sharing at $p < 0.1$. This result reveals that inventory turnover performance is influenced by various factors (Bagchi and Skjoett-Larsen, 2005). Previous research confirms this result in which SCM practices contribute to higher inventory turnover (Frohlich and Westbrook, 2001; Simatupang and Sridharan, 2005). To achieve high inventory turnover, companies need to improve their internal efficiency through elimination of non-value added activities and excessive inventories. This can be achieved by effectively implementing IT in all operational activities. In addition, companies also need to go beyond their internal operations to work closely with their external counterparts both upstream and downstream in their supply chain. Close coordination amongst members of a supply chain is facilitated by high level of information sharing.

Avoidance of product reject/return. In terms of avoidance of product reject/return, the information sharing and training significantly influenced the mean of this performance measure, both at $p < 0.05$. These two practices explained 8.9% and 6.7% of variances in avoidance of product reject/return respectively. This finding shows that training is an important factor to increase product quality which in turn increases the avoidance of product reject. Information sharing allows the company to better predict their customers demand.

Level of Sales. The t-test analysis shows that only information sharing and IT significantly differentiated the level of sales performance, both at $p < 0.1$. These two practices only explained small variance in the level of sales which are 5.5% and 4.5% respectively. Information sharing helps companies to increase their forecasting accuracy and increase their responsiveness in meeting customers' demand. High level of information sharing requires to managing information systems. In addition, IT also allows the company to improve their order processing and other operational activities which in turn influence the level of sales performance. The low level of influence of these two practices on the level of sales suggests that the level of sales can be influenced by marketing and promotion, which were not captured in the analysis.

Cost Reduction. There were significant differences in term of cost reduction performance between low and high level of all SCM practices except supplier and customer relationship. Internal operation, information sharing, and IT significantly differentiate the cost reduction performance at $p < 0.01$ while training was significance at $p < 0.05$. Information sharing showed the highest significant level which explained 16.7% of variance in cost reduction performance. Internal operations and IT explained 14% and 13.2% of variance in cost reduction respectively whilst training contributed 8.1%. The results confirm previous research in the extant literature that information sharing results in cost reduction through reduced manufacturing cost, logistics cost and inventory costs (Gavirneni *et al.*, 1999; Lee *et al.*, 2000; Yu *et al.*, 2001). It is also expected that cost reduction was correlated with internal operations and IT. Cost reduction requires improvement in internal operations through lead-time reduction and continuous improvements. Effective implementation of IT can facilitate the improvement of internal operations and other various activities along a supply chain.

Effectiveness in Meeting Customers' Requirements. The analysis reveals that companies' effectiveness in meeting customers' requirements was significantly differentiated by the level of information sharing and supplier and customer relationship. Information sharing showed higher contribution which explained 14.1% of variance in effectiveness in meeting customers' requirement at $p < 0.01$. Suppliers and customers relationship explained 9.4% of variance at $p < 0.05$. Information sharing allows companies to better understand customers' requirements. Understanding customers' demand enables companies to segment their customers to be able to deliver highly customized products or services (Lee, 2000). Translating customers' requirements into products or services requires companies to work closely with their partners both upstream and downstream along their supply chain. Lee (2002) contends that these two practices are essential in aligning supply chain strategy with the uncertainty both upstream and downstream.

CONCLUSION

The extant literature suggests that the implementation of SCM can considerably improve organisational performance such as inventory turnover, increased customer service level and reduced cost (Kopczak and Johnson, 2003; Lee, 2000; Lee and Billington, 1992; Mentzer, 2004). The empirical results of this study confirm the theory that SCM practices considerably improve companies' performance. Moreover, the results specifically highlight that IT and information sharing significantly contribute to most performance measures. The internal operations practice contributes to more performance measures than supplier and customer relationship practice. This indicates that relationship of suppliers and customers practices is mediated by internal operations practice. Firms need to achieve internal integration before embarking to synchronizing their activities with their suppliers and customers.

The main contribution of this research is the introduction of training as one of the SCM practices. The results clearly highlight that training significantly contributes to improving SCM performance. This suggests that successful implementation of SCM is highly attributed to the readiness of human resources in conducting all supply chain activities.

This study has some important managerial implications. First, firms should continuously improve their internal processes and achieve inter-functional coordination through several strategies such as, creating system visibility from distribution through purchasing, focus on customers, overcoming functional silos, and build cross-functional teams to accelerate continuous improvement. This high degree of internal integration is a prerequisite for firms before they can synchronize their activities with their customers and suppliers (Stevens, 1989). Second, firms should continuously seek effective deployment of IT into their supply chain activities with suppliers and customers, and their internal operations. The effective use of IT can greatly increase the coordination of activities with supply chain partner. The advancements in such as the Internet allows each supply chain member to increase integration with relatively low cost. IT also facilitates companies to share more information with their partners. Information sharing can be broadened into a more strategic level such as new product idea, promotional plan, and even knowledge transfer between members of the supply chain, increasing the range and intensity of collaboration with supply chain partners. Third, firms should build and continuously improve their employees' skills and capability in facing the changing competitive environment. The implementation of SCM requires new skills to utilise the shared information from many different partners and to work collaboratively with many different functions within a company and with their supply chain partners.

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