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IMPACT OF INFORMATION TECHNOLOGY (IT) TOOLS, PARTNER RELATIONSHIP AND SUPPLY CHAIN PERFORMANCE

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ABSTRACT

This paper proposes a model that assesses the usage of information technology (IT) tools, commitment of partner relationships, and supply chain performance in the Malaysian manufacturing industry. A total of 250 questionnaires were distributed to manufacturing companies located in Penang, which is in the northern region of Malaysia. Applying multiple regression analysis, the study indicated that a higher level of supply chain partner commitment leads to a higher level of supply chain reliability and flexibility. Trust among supply chain partners also contributes to improving supply chain flexibility. The study focused only on inter-organisational relationships. Future research should examine how both inter- and intra-organisational collaboration impact supply chain performance. Although researchers have recognised that IT is an enabler of supply chain management (SCM) activities, there has been limited research that has directly associated the usage of IT and partner relationships to supply chain performance. This research is essential in order to ascertain the impact of IT usage and partner relationships on improving supply chain performance, particularly in the Malaysian manufacturing environment.

Keywords: IT tools, trust, commitment, supply chain performance, Malaysia

INTRODUCTION

In today's global digital economy, organisations compete, based on cost, quality, delivery time, and flexibility in order to capture market share and to survive. To continue growing, organisations need to develop their own core competencies and design superior supply chains by strengthening partnerships with suppliers, retailers, distributors, and customers (Kotler & Keller, 2005). Providing meaningful products or services to customers in the context of a technology-driven competitive business environment is important to the success of supply chains (Bowersox, Closs, & Stank, 2000).

Wisner and Tan (2000) defined SCM as an integration of different key functions consisting of purchasing, demand management, distribution planning, quality management, manufacturing planning, and materials management throughout the entire supply chain for the purpose of moving material components, products, and services until final delivery to the end user. They also concluded that SCM's short-term objectives are to increase productivity, reduce inventory, and decrease cycle time but its ultimate goals are to increase customer satisfaction, increase market share, and increase profits for the entire supply chain in the long-run.

Although SCM generates advantages, there are many barriers that make it difficult to implement. According to Moberg, Speh, and Freese (2003), there are seven obstacles that hinder supply chain success:

1. lack of trust,
2. lack of understanding on the importance of supply chain collaboration and lack of commitment to the development of an effective supply chain,
3. fear of accountability,
4. different goals and objectives among supply chain partners,
5. inadequate information systems,
6. excessive focus on short-term performance, and
7. involvement in an excessive number of supply chains, which creates weak relationships among supply chain members.

Inter-organisation relationships must be emphasised in order to develop superior supply chain networks. Strong inter-organisation relationships ultimately greatly improve the performance of the supply chain. IT allows rapid communication between buyers and suppliers and enables sharing large quantities of quality information on both tactical and strategic operations. This benefits supply chain performance in terms of inventory velocity, delivery time, responsiveness, costs, and product development cycle time (Peterson, Ragatz, & Monczka, 2005; Sanders, 2005).

Realising the importance of SCM in building sustainable competitive advantage for their products or services, many organisations have started practicing SCM. However, regardless of the amount of effort invested in implementing SCM, many organisations are still unable to enjoy the benefits of this implementation. Only a few organisations, such as Dell, Wal-Mart, and Toyota, have succeeded in improving their supply chain performance. The findings of a study by Consumer Electronics Supply Chain Academy (2008) found that looked at the breadth of the performance gap between the market leaders, and the average and lagging companies found that the leading high-tech OEMs significantly outperformed the industry in all performance area. The widening gap between leading and average organisations explains industry inequality (Thoo, 2004). Weak relationships,

technological inadequacies, discomfort in sharing information, and lack of top management support are a few barriers that impact supply chain performance (Moberg et al., 2003).

Although researchers have recognised that IT is an enabler of SCM activities, there has been limited research that has directly associated the usage of IT and partner relationships to supply chain performance, particularly in the Malaysian manufacturing environment. Therefore, the purpose of this research is to develop a model that predicts the usage of IT tools, commitment of partner relationships, and supply chain performance in the Malaysian manufacturing industry.

LITERATURE REVIEW

Usage of IT Tools

Usage of IT tools is defined as IT used to facilitate SCM practices (Li, 2002b). In this study, usage of IT is defined as the use of IT to facilitate inter-organisation activities because this study focuses on the buyer/supplier relationship. Many researchers have extensively examined the role and impact of specific types of IT tools in the supply chain field (Walton & Gupta, 1999; Lee & Whang, 2001; Tarn, Yen, & Beaumont, 2002; Chalasani & Sounderpandian, 2004; Chou, Tan, & Yen, 2004; Siau & Tian, 2004; Lankford, 2004; Sanders, 2005; Sanders & Premus, 2005).

Murphy and Daley (1996) found that Electronic Data Interchange (EDI) is an important tool if logistic organisations want to be successful international freight forwarders. EDI enables the transfer of data in an agreed electronic format, such as invoices, bills, and purchase orders, between companies. About 57% of survey respondents cited the benefits of EDI implementation as "quick access to information" and 34% cited "better customer service". Their research showed that only large forwarders tend to use EDI compared with smaller forwarders, as smaller forwarders do not intend to use EDI in the future. In the inventory management arena, EDI was proposed as a solution to minimise the bullwhip effect. EDI can enhance supplier delivery performance, which will improve the performance of supply chain (Lee, Padmanabhan, & Whang, 1997). This is further supported by Yu, Yan, and Cheng (2001), who found that using EDI to support a Vendor-Managed Inventory (VMI) strategy not only eliminates the bullwhip effect but also enhances the overall performance of the supply chain. VMI is an inventory planning and fulfilment technique in which a supplier is responsible for monitoring and restocking customer inventory at the appropriate time to maintain predefined levels. The vendor is given access to current customer inventory and forecast and sales order information to initiate

replenishment as required. VMI directly links suppliers to a manufacturing base and EDI is then applied to generate material "pull" signals. IT also shortens delivery lead time. Implementation of IT has enabled organisations such as the Campbell Soup Company to reduce its order processing time from one week to two or three days (Cachon & Fisher, 2000). Hence, with VMI, suppliers have access to the purchasing company's demand, which allows suppliers to improve supply ordering and production scheduling in addition to reduce inventory levels in the supply chain (Wisner, Leong, & Tan, 2005).

Additionally, investment in Supplier Relationship Management (SRM) software to improve communication and collaboration with supply chain partners is essential. SRM is the management of information flow between suppliers and purchasing organisations and the integration of supplier information in the buyer's procurement process. The application of SRM has a positive impact on cost reduction as well as on improving procurement and providing real time visibility across the supply chain (Wisner et al., 2005). SRM provides support solutions to assist in planning, execution, and optimisation of the supply chain. SCM software may include strategic planning, demand management, supply management, fulfilment planning/execution, warehouse management, transportation management, and so on.

Frohlich (2002) examined IT from the Internet dimension. Internet technology has significantly enabled VMI, Electronic Fund Transfer (EFT), and collaborative planning, forecasting and replenishment (CPFR) (McCormack & Kasper, 2002). EFT permits the electronic transfer of money or funds across the supply chain without the exchange of paper money. Hence, this facilitates rapid transfer of goods and supplies between the buyer and seller. In addition to smoothing the coordination of cash flow in the supply chain, IT is required in managing the movement of physical goods along the supply chain. IT tools like Distribution Requirement Planning (DRP) provide a linkage between warehouse operations and transportation requirement. DRP reconciles demand forecasts against inventory and transportation capacities. Additionally, usage of a Data Warehouse (DW), which provides a combination of many different databases across an entire enterprise, aids management in the decision-making process. The system enables the integration of data and effective management of information from various sources at a single location. Organisations that apply DW are able to access to a wide variety of data. For example, information regarding sales or trend reports at a particular location or region can be obtained. The stored data can then be used for reporting and information analysis. Hence, DW provides speed and cost effectiveness in meeting management information requirements.

The Internet or an extranet also enables the integration of supply chains with lower cost, the availability of rich content, and support for linking supply chain

partners who are located at long distances from each other. The Internet provides direct connectivity to anyone over a local area network (LAN) or Internet Service Provider (ISP) using a common set of communications protocols. On the other hand, an extranet is a collaborated network that uses internet technology to deliver information from within an organisation to a defined group of users outside of the organisation, typically customers, suppliers, or business partners.

IT has enabled inter-enterprise communication across organisations in the supply chain in addition to having a significant impact on the company's performance. For example, Sanders and Premus (2005) indicated that IT has a significant direct impact on firm performance. Large volumes of information can move smoothly and inexpensively in real time along the supply chain. Thus, IT allows the pool of data to be transferred in a meaningful and updated manner, enabling supply chain members to optimise effective strategies which are critical to the success of the supply chain. The ability of the supply chain partners to retrieve, manage, and track the flow of relevant information across the chain from the DW has also been greatly enhanced by the rapid growth of IT (Kulp, Lee, & Ofek, 2004).

In short, in order to react quickly to supply chain uncertainty and enhance customer satisfaction, organisations need to develop capable information systems to gather and exchange information with supply chain partners (Bowersox et al., 2000). The evolution of IT has lowered transaction costs and eased information movement, which has allowed for better decision-making and improved the base time performance (Lewis & Talayevsky, 2004).

In addition, Chen and Paulraj (2004) proposed a construct for information technology that emphasised information integration via electronic transactions and communications between organisations and supply chain partners. They noted that IT is considered among the most important constructs in the SCM domain because it improves supply chain efficiency. The application of IT in enabling collaboration across supply chain partners is evidenced in Chen, Yang, and Li (2007). Their study indicated that organisations that implement CPFR with suppliers and customers witnessed significant positive effects on supply chain performance. However, in this research, IT is conceptualised in terms of the diverse array of IT usage, such as EDI and VMI, between manufacturing organisations and their suppliers.

Partner Relationships

In order to achieve competitive advantage and provide quick responses to market needs, the success of each organisation depends, in part, on support from chain partners (Anderson & Narus, 1990). Thus, strong partnerships are critical to achieving this goal. Strong partnerships emphasise long-term working

relationships, problem-solving efforts, and joint plans for the future among chain partners, who make their success interdependent (Spekman, Kamauff, & Myhr, 1998). Competitive advantage can be gained through partnership by providing better service to customers with improved delivery systems and lead times. For example, Boeing worked closely with its entire supply chain and finally successfully won bids in competition with Airbus (Berry, Towill, & Wadsley, 1994). Effective management of the buyer-supplier relationship is an important requirement for supply chain management (Chen & Paulraj, 2004).

SCM is built on a foundation of trust and commitment (Lee & Billington, 1992). Thus, a high level of trust, commitment, and a shared common vision among supply chain partners is indeed essential for inter-organisation collaboration (Spekman et al., 1998). According to Bowersox et al. (2000), formal collaborative partnerships must be backed with mutual trust, shared vision and objectives, and required structures, frameworks, and metrics that encourage inter-organisational behaviour. High levels of trust, strong commitment, and extensive information sharing among supply chain partners are key elements to achieving successful supply chain performance (Kwon & Suh, 2004).

Lee and Kim (1999) defined partnership quality as trust, business understanding, benefit and risk sharing, conflict, and commitment in their research model. For an organisation that plans to outsource, fostering a cooperative relationship based on these relationship variables is important to gain high quality service from their outsourcing partners. Mohr and Spekman (1994) showed that trust, commitment, and coordination significantly impacted levels of satisfaction and dyadic sales. However, interdependence attributes were not indicators to predicting partnership success. Hence, building a strong relationship between the supplier and purchaser is an important action in building a successful supplier alliance.

Wong and Sohal (2002) looked at trust and commitment from the relationship marketing perspective. Two levels of relationships, salesperson and store, were analysed from the customer's point of view. They found that trust and commitment play important roles in the customer relationship. Higher levels of trust and commitment lead to higher levels of customer retention and, in turn, generate handsome profit margins for organisations.

Based on the literature review, trust and commitment are two essential characteristics of relationships that have been researched at length (Lee & Billington, 1992; Mohr & Spekman, 1994; Morgan & Hunt, 1994; Monczka, Peterson, Handfield, & Ragatz, 1998; Peterson et al., 2005; Moore, 1998; Spekman et al., 1998; Garbarino & Johnson, 1999; Moberg, Cutler, Gross, & Speh, 2002; Wong & Sohal, 2002; Kwon & Suh, 2004). Hence, partner relationships refer to the level of trust and commitment between supply chain

partners in this study. Trust is defined as the confidence of one party in the exchange partner's reliability and integrity. Commitment is defined as "an exchange partner believing that an on-going relationship with another is important as to warrant maximum efforts at maintaining it; that is, the committed party believes the relationship is worth working on to ensure that it endures indefinitely" (Morgan & Hunt, 1994). This research conceptualised the partner relationship to involve the elements of trust and commitment between manufacturing organisations' relationships with their suppliers. IT is an enabler in SCM; however inter-organisational interactions are only possible if there is an enhanced partner relationship in terms of trust and commitment among partners. The next section reviews the literature on trust and commitment as attributes that form the partner relationship.

Trust

Trust has been highly analysed by many researchers from different disciplines (Doney & Cannon, 1997; Diggles & Pollard, 2003; Grossman, 2004). In the supply chain context, purchasing organisations normally will buy from suppliers whose client organisations believe that they are reliable, competent, and responsive to the customer's best interests. Suppliers must develop and maintain a level of buyer trust that will lead to more favourable purchasing outcomes (Doney & Cannon, 1997). According to Bowersox et al. (2000), buyers and sellers do not fully trust each other. Lack of trust between supply chain partners reduces willingness to share tactical and strategic information. Sellers have to guess buyer demand when buyers do not share forecast information. In this situation, seller overall efficiency in operations will be negatively affected.

Cross and Kelley (2004) agreed with Bowersox et al. (2000), pointing out that social, political, or economic exchange is not possible without trust. Berry et al. (1994) found that the most volatile organisations do not seriously believe in the power of trust, which is the most important factor in benefitting from closer relationships. Transaction costs increase when there is lack of trust among trading partners and result in inefficient and ineffective performance (Kwon & Suh, 2004). In a case study conducted by Smith and Smith (2005) on performance measures in the supply chains between Australian healthcare and auto textile industry, the authors showed that the development of cooperative and trusting relationships between supply chain partners positively impact organisational performance. The study by Fynes, Voss, and de Burca (2005a) found that communication between supply chain members provides a basis for the development of trust, which eventually leads to enhanced cooperation among supply chain members. The study shows that trust is built over time and provides a strong foundation for effective cooperation among supplier chain members and is considered one of the most important dimensions of supply chain relationships.

Consequently, effective supply chain relationships have resulted in enhanced manufacturing performance regarding cost reduction and quality improvement. Additionally, a study by Chen et al. (2007) noted that trust among supply chain partners is critical to effective supply chain collaboration. Therefore, because trust is important in building inter-organisational relationships, this research suggests that supply chain performance is associated with high levels of trust developed among manufacturing firms and suppliers.

Commitment

Similar to trust, commitment is one of the most important ingredients for successful partnership alliances (Mohr & Spekman, 1994; Monczka et al., 1998; Lee & Kim, 1999). Fynes, Voss and de Burca (2005b) conceptualised commitment as one dimension of supply chain relationship quality, in addition to trust, communication, adaptation, cooperation, and interdependence. The study found that commitment and trust are essential requirements to managing supply chain relationships. Commitment in this study is based on social exchange theory (Morgan & Hunt, 1994). Relationship commitment refers to the willingness of buyers and suppliers to commit to their relationships by committing resources, such as time, money, and facilities, to their relationships. These types of resources are defined as "asset specific" resources because they are directed specifically towards the other party. Willingness to commit different types of assets for future transactions resulted in successful alliances between supply chain partners (Monczka et al., 1998). Li (2002a, 2002b) agreed with Monczka et al. (1998) that commitment induces partners to allocate resources to maintain and to continue to enhance the effectiveness of the supply chain.

Commitment is an important variable for long-term success because supply chain partners are willing to sacrifice short-term benefits for long-term success (Mentzer, Min, & Zacharia, 2000). Committed suppliers will retain loyal customers due to efforts to maintain relationships indefinitely. Repeated orders from loyal customers are also based on strong relationships built upon mutual commitment. Thus, commitment among supply chain partners is a major factor in achieving valuable outcomes for organisations. In a nutshell, both trust and commitment must be in place to produce an outcome which promotes efficiency, productivity, and effectiveness in the supply chain. Therefore, this study postulates that partner relationships characterised by trust and commitment lead to significant positive effects on supply chain performance.

Supply Chain Performance

Different researchers have suggested different types of measurements to evaluate performance. For instance, Chin, Tummala, Leung, and Tang (2004) suggested

eight measurements, namely, delivery time, customer satisfaction, cost reduction, on-time delivery, inventory turnover, system reliability, market share, and value-added activities, but only three measurements (delivery times, customer satisfaction, and cost reduction) were found to be commonly used to evaluate SCM. Timeliness, profitability, growth, availability, and product and service offering were used as measurements by Min and Mentzer (2004). Peterson et al. (2005) examined supply chain performance in three dimensions: (a) material cost performance, (b) supplier performance, and (c) firm performance. Gunasekaran, Patel, and Tirtiroglu (2001) looked at SCM performance from the strategic, tactical, and operational levels. Additionally, they developed key performance metrics emphasising performance dealing with suppliers, delivery, customer service, inventory, logistics costs in SCM, and most importantly customer satisfaction. Li (2002a, 2002b) proposed five major dimensions to measure SCM performance: supply chain flexibility, supply chain integration, customer responsiveness, supplier performance, and partnership quality.

Performance selection is important for a more complete and accurate analysis that can be used as a measurement to enhance the effectiveness of supply chain models. Although there are many measurements that can be used to evaluate performance, many of these methods use inappropriate or ineffective performance measures (Beamon, 1999). Seeing no standardised model being offered to measure SCM performance, the Supply Chain Operations Reference (SCOR) model was created by the SCC to serve this purpose. There are five performance attributes used in the SCOR model: reliability, responsiveness, flexibility, cost, and asset utilisation (Stephens, 2000).

Referring to supply chain performance attributes and level 1 metrics quoted by SCOR, reliability refers to delivery performance that can be evaluated in seven different ways: shipping the correct product, shipping the correct quantity, shipping to the right location, shipping at the required time, shipping to the right customer, shipping a product in good condition and adequate packaging, and shipping a product with correct documentation (Thoo, 2004). Driven by customer focus, each dimension is important in determining whether a perfect delivery has taken place (Gunasekaran et al., 2001). This will increase customer satisfaction and indirectly help organisations achieve revenue and profit targets.

Responsiveness is measured by order fulfilment lead times that refer to the time between receipt of the customer's order and when the final product is supplied to the customer. Responsiveness also includes customer query time, which is the time an organisation takes to respond to a customer's inquiry. Customer inquiries can range from order status, product information, price quotes, stock availability, etc. (Gunasekaran et al., 2001). Customer responsiveness as defined by Narasimhan and Jayaram (1998) is whether delivery is achieved when the

customer requires it. This attribute is one of the major goals of supply chain integration. Beamon (1999) categorised customer responsiveness under output performance measurement. Generally, an organisation's goal is to fulfil customer needs. Thus, output measurement must address the customer's goals and values. Fast cycle time improves the supply chain response time that leads to substantial competitive advantage (Bower & Hount, 1988; Gunasekaran et al., 2001).

Flexibility refers to an organisation's ability to adapt and react effectively to dynamic market changes (Li, 2002a, 2002b; Vickery, Calantone, & Droge, 1999). Vickery et al. (1999) underlined five supply chain flexibilities:

(a) product flexibility (customisation),
(b) volume flexibility,
(c) launch flexibility (new product introduction),
(d) access flexibility (widespread distribution), and
(e) responsiveness to target markets.

Vickery et al. (1999) suggested that SCM flexibility along the supply chain is the key response to environmental uncertainties that should be measured from an integrated customer-oriented perspective. Because the supply chain exists in uncertain business environments, an organisation's ability to accommodate volume and schedule fluctuations is critical to the success of the supply chain. Flexibility, as a result of the development of IT such as flexible manufacturing system (FMS), group technology (GT), and computer-integrated manufacturing (CIM), enables products to be customised to fit individual needs. Flexibility influences customer order decisions and is one of the strategic tools for organisations to win customers (Gunasekaran et al., 2001).

Cost is identified as a critical part of the supply chain and is often used as a measurement of resources. Material costs are usually the organisation's major cost and accounts for 60% to 80% of cost of goods sold (Jantan, Ramayah, & Khaw, 2000). An organisation's basic goal is to produce more with lower costs. Minimising resources while fulfilling customer demand is also the organisation's goal. By doing so, organisations will enjoy higher profit margins.

For this study, supply chain performance measurement is based on the SCOR model, which consists of cost, reliability, flexibility, responsiveness, and asset utilisation (http://www.supply-chain.org). However, asset utilisation is not used in this study because it is used to measure an organisation's effectiveness in managing all of its assets to meet demand (Reichardt & Nichols, 2003).

METHODOLOGY

Research Model

This research draws upon the work of Sanders and Premus (2001), which evaluated the impact of IT usage on a range of organisational performance measures. Because this study focuses on the buyer-supplier relationship, adaptations have been made by focusing on inter-organisational relationships. Relational factors, trust and commitment, as independent variables were added because supply chain players consist of human factors and technologies. Organisational performance was replaced with supply chain performance, which will serve as a proxy for organisational performance. Organisational performance can only be achieved with good supply chain performance (Li, 2002a). The research framework of this study is shown in Figure 1.

Research Methods

Questionnaires were used to collect the required data from manufacturing companies located in the northern region of Malaysia over a period of two months. A total 250 questionnaires were distributed through e-mail and postal mail and were directed to purchasing directors, managers, executives, and buyers in manufacturing companies who had direct contact with suppliers. The list of possible companies was generated from the Federation of Malaysian Manufacturers (FMM) Directory, 2005, and the final sample was generated using a random sampling method. A total of 64 questionnaires were collected from respondents, a response rate of approximately 26%. However, of the 64 questionnaires, only 58 questionnaires could be used. Four respondents answered the questionnaires incompletely and another two questionnaires were rejected due to improper answers.

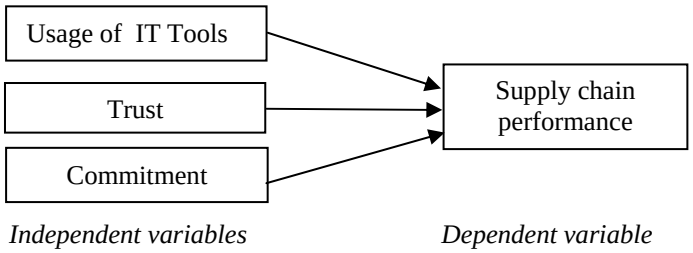

Figure 1. Research framework.

Measurement and validation

The questionnaire in this study was derived from the literature, either through adoption or slight modification to make it relevant to this study. A pilot test was performed by distributing the questionnaire to purchasing managers from four organisations to solicit feedback on questionnaire design. The pilot test was conducted to achieve an understanding among purchasers in order to improve the overall quality of the questionnaire. Based on their feedback, several minor changes were made to tailor the questionnaires to the target audience. The questionnaires were deemed ready for distribution after these modifications.

Research instruments

Items for "usage of IT tools" were adopted from Li (2002a, 2002b): EDI, internet, extranet, EFT, DRP, SRM, VMI, DW, and SCM software. A 5-point rating scale, ranging from "1 = not at all" to "5 = very high," was adopted to measure the usage of IT tools used by both organisations and their suppliers to facilitate the supply chain.

Partner relationships consisted of trust and commitment. Six items were used to measure trust. Four items were adapted from Li (2002a, 2002b) and two items were adapted from Mohr and Spekman (1994). Commitment was also measured by six items and these items were adopted from Li (2002a, 2002b). The study used a 5-point Likert scale ranging from "1 = strongly disagree" to "5 = strongly agree" to measure relationships between organisations and their key suppliers.

A total of 13 questions were constructed based on the four dimensions of performance from the performance attributes and level 1 metrics of the SCOR model: reliability, flexibility, responsiveness, and cost. A 5-point rating scale ranging from "1 = far below industry average" to "5 = far above industry average" was used to measure supply chain performance based on industry averages to avoid variation between industry standards.

RESULTS

Respondent Profile

Table 1 shows that 46.6% of respondents are senior executives, while 36.2% of respondents hold middle level managerial positions; another 12.1% of respondents hold higher level managerial posts.

Table 1
Respondent Personnel Profile.

Variable	Frequency	Percentage (%)
Job title		
Director/Senior manager	7	12.1
Manager/Assistant manager/Section head	21	36.2
Senior executive/Executive	27	46.6
Others (buyer)	3	5.2

Respondent Organisation Profile

The majority of the respondents come from Original Equipment Manufacturers (OEM), with 74% of their primary business involved in the electronic and electrical industry and 43.1% of the organisations have been operating more than 20 years; furthermore, 76% of the organisations are fully owned by foreigners and half come from Europe or America, with 57% of companies employing more than 1,000 people (Table 2).

Table 2
Respondent Organisation Profile.

Variable	Frequency	Percentage (%)
Nature of business		
OEM	27	47.56
Electronics Manufacturing Services (EMS)	16	27.59
Supporting industry	15	25.86
Primary business		
Electronic/electrical	43	74.14
Plastic and rubber products	5	8.62
Metal products	2	3.45
Computer products	5	8.62
Others	3	5.17
Years in industry		
1–5 years	4	6.90
5.1–10 years	6	10.34
10.1–15 years	20	34.48
15.1–20 years	3	5.17
> 20 years	25	43.10

(continued on next page)

Table 2 *(continued)*

Variable	Frequency	Percentage (%)
Organisation's ownership		
Fully Malaysian	9	15.52
Local and foreign joint venture	5	8.62
Fully foreign owned	44	75.86
Country of origin		
Malaysian	10	17.24
Asian country	19	32.76
Europe/America	29	50
Number of employees		
100 and below	11	18.97
10–500	10	17.24
501–1000	4	6.90
Above 1000	33	56.90

Respondent Supplier Profile

Electronic components are the major components purchased by respondent organisations. Respondent organisations have an average of nine years of working relationship with their suppliers, and 53% of their supplier organisations are owned by foreigners, with owners originating from Asian countries, Europe, and America. Tables 3 and 4 provide more details about the respondent supplier profile and years of working relationship.

Table 3
Respondent Supplier Profile.

Variable	Frequency	Percentage (%)
Product type supplied by suppliers		
Accessories	3	5.17
Electronics component/subassembly	26	44.83
Mechanical components	5	8.62
Fixture/Stencil/Equipments	7	12.10
Packaging/Manual/Flyer/Insert	5	8.62
Software/Firmware	4	6.89
Service provider	4	6.89
Others	4	6.89

(continued on next page)

Table 3 *(continued)*

Variable	Frequency	Percentage (%)
Number of employees		
100 and below	15	25.86
101–500	15	25.86
501–1000	4	6.89
Above 1000	24	41.38
Supplier's organisation ownership		
Fully Malaysian	18	31.03
Local and foreign joint venture	9	15.52
Fully foreign owned	31	53.45
Supplier's country of origin		
Malaysian	23	39.65
Asian country	21	36.21
Europe/America	14	24.14

Table 4
Factor Loadings for Partner Relationships.

Questionnaire items	Component	
	1	2
Our supplier is reliable	**0.874**	0.199
We feel that we get a fair deal from our supplier.	**0.833**	0.168
Our supplier has been open and honest in dealing with us	**0.808**	0.138
Our supplier respects the confidentiality of the information they receive from us.	**0.692**	0.341
Our relationship with our supplier is marked by a high degree of harmony.	**0.661**	0.377
Transactions between our supplier and us do not have to be closely supervised.	**0.516**	0.239
Our supplier abides by agreements as well.	0.114	**0.843**
We and our supplier always try to keep each other's promises.	0.102	**0.763**
Our supplier has invested a lot of effort in building relationship with us.	0.288	**0.729**
We expect to increase business with our supplier in the future.	0.358	**0.645**
Eigenvalue	5.79	1.43
Percentage variance (60.14)	32.64	27.50

Goodness of Measures

Factor analysis was conducted to group the items related to each other under the same construct (Hair, Anderson, Tatham, & Black, 1998). A Varimax rotation method was applied to all variables. The selected factors were based on eigenvalues equal to or greater than 1.00. Within a factor, the cut-off point for

significant factor loading was at least 0.50 on one factor, while other factors were greater than 0.35 (Igbaria, Iivari, & Maragahh, 1995). However, this condition was slightly relaxed for items with high factor loadings with the gap of greater than 0.20 compared with another factor. Then, the factors and selected items were grouped and renamed accordingly.

Factor analysis was performed on 12 items in the partner relationship scale. The result is shown in Table 4. The KMO was 0.86 and Bartlett's test of sphericity was significant at the 0.01 level. The anti-image correlation matrix ranged from 0.775 to 0.929 (> 0.50), so there were sufficient correlations among the items. Two factors were extracted; these factors accounted for 60.14% of the variance. Two items were excluded due to cross loadings. Factor 1 is labelled as trust and Factor 2 is labelled as commitment. As for supply chain performance, the factor structure proposed by the SCOR model was maintained (reliability, flexibility, responsiveness, and cost).

Reliability Analysis

Reliability analysis is established by testing whether the items grouped under a factor are internally consistent and stable. Cronbach's alpha (α) was used to analyse the reliability of the instruments. Reliability over 0.80 is good; reliability in the range of 0.70 is acceptable; and reliability less than 0.60 is considered poor (Sekaran, 2003). Results of this analysis are shown in Table 5. Usage of IT tools, commitment to the partner relationship, and supply chain performance are accepted based on Cronbach α above 0.70. Results of the descriptive analysis for all variables are presented in Table 7. The mean for all variables ranges between 2.99 to 3.88. The highest mean is reliability (3.88) and the lowest mean is usage of IT tools (2.99).

Table 5
Reliability Coefficients, Mean and Standard Deviation (SD) for the Major Variables.

Variable	Number of items	Cronbach's Alpha	Mean	SD
Usage of IT tools	9	0.84	2.99	0.82
Trust	6	0.86	3.76	0.54
Commitment	4	0.80	3.87	0.48
Reliability	5	0.76	3.88	0.49
Responsiveness	3	0.75	3.51	0.53
Flexibility	3	0.83	3.46	0.59
Cost	2	0.74	3.27	0.59

Note: All the variables were measured based on a 5-point Likert scale.

We also ran a zero order correlation between all variables to establish whether there was predictive and discriminant validity. The results are shown in Table 6. All independent variables were correlated with the dependent variables except for usage of IT tools, which indicates that there is predictive validity. Discriminant validity refers to the extent to which measures of two different constructs are relatively distinctive [their correlation values were neither an absolute value of 0 or 1 (Campbell & Fiske, 1959)]. As can be seen, all factors are not perfectly correlated, where their correlation coefficients range between 0 and 1. Hence, we can conclude that discriminant validity has been established.

Multiple Regression

Multiple regression analysis was evaluated to determine the relationship between usage of IT tools and partner relationship (trust and commitment) and supply chain performance. Usage of IT tools and partner relationship were defined as independent variables and supply chain performance was defined as the dependent variable. Supply chain performance was composed of four factors: reliability, responsiveness, flexibility, and cost. Table 7 shows the results of the regression analyses.

Table 6
Intercorrelations among the Major Variables of the Study.

	Relia-bility	Respon-siveness	Flexi-bility	Cost	IT tools	Trust	Commit-ment
Reliability	1.000						
Responsiveness	0.435**	1.000					
Flexibility	0.4885**	0.645**	1.000				
Cost	0.407**	0.484**	0.551**	1.000			
IT Tools	0.123	0.131	0.129	0.348**	1.000		
Trust	0.439**	0.536**	0.626**	0.550**	0.382**	1.000	
Commitment	0.492**	0.484**	0.686**	0.576**	0.330**	0.659**	1.000

Note: $^{**}p < 0.01$

Table 7
Regression Results between Usage of IT Tools, Partner Relationship and Flexibility.

	Dependent variable			
Independent variables	Reliability (Std. Beta)	Responsiveness (Std. Beta)	Flexibility (Std. Beta)	Cost (Std. Beta)
Usage of IT tools	–0.086	–0.108	–0.176	0.129
Trust	0.228*	0.246*	0.359**	0.263*
Commitment	0.370**	0.415**	0.508**	0.361**
F value	0.272	0.327	0.550	0.397
R^2	0.232	0.290	0.525	0.364
Adjusted R^2	6.725**	8.744**	22.010**	11.865**

Note: * $p < 0.05$, ** $p < 0.01$

Trust and commitment were found to be positively related with all four supply chain performance measures of reliability, responsiveness, flexibility and cost. Usage of IT tools was not found to be a significant predictor of all four supply chain performance measures.

DISCUSSION

The results show an insignificant relationship between usage of IT tools and supply chain performance. Surprisingly, this result contradicts previous findings (Sanders & Premus, 2001; Chou et al., 2004). IT tools were not highly used. This might be because IT tools cannot create flexibility in response to changing environments (see Table 7). This is because structured and standardised routines of IT tools are unable to cater to business cases that require more flexible ways of doing business. Thus, human intervention is still required for flexibility. In order to keep pace with a changing business environment and to cope with new business strategies and practices, organisations must constantly invest in upgrading its existing system in order to make its IT flexible to any circumstance needs (Orshesky, 2003).

Trust was found to be significantly and positively related to the supply chain's performance. Implementation of SCM requires a high degree of trust, because an organisation's internal activities and customer demand forecasts need to be accessed by suppliers. Openness allows for more flexibility by suppliers in managing production capacity, monitoring buyer inventory, and better responding to the volatility in the level of demand and changes in product mix. However, flexibility must be coupled with commitment from suppliers to ensure reliable performance. According to Kwon and Suh (2004), commitment was found to be influenced by the level of trust.

This finding is consistent with Morgan and Hunt (1994), who studied relationship and performance between manufacturers and their customers. Committed suppliers will ensure that products are delivered to the right place in the correct quantities in good condition as per the customer's requested date. At the same time, supply chain partners are also willing to sacrifice for the long-term partnership by accommodating customer demand with more flexibility in terms of responding to demand. In summary, the findings indicated that the impact of commitment is more important than trust on supply chain performance.

IMPLICATIONS

The findings of this study raise several implications for supply chain performance. The mindset that heavily investing in IT tools will automatically improve supply chain performance needs to be changed. Successful SCM is the result of human interaction that can only be supported by IT, not replaced.

The relational factors of trust and commitment were found to positively impact supply chain performance. Commitment and trust, which are central to successful partner relationships, must be formed to reduce the time spent by organisations verifying and monitoring their supply chain partner's credibility, reliability, and trustworthiness. Instead, time should be used for more value-additive activities which can enhance the organisation's efficiency and productivity. Thus, supply chain partners who demonstrate higher levels of trust and commitment along the chain will perform better in terms of quality, delivery, and cost. Interim partnerships built on trust and commitment can be one way to achieve resource-based advantages and retain a competitive edge. The results of this study suggest that management should strengthen and initiate more relationships with their supply chain partners in order to achieve improved supply chain performance.

LIMITATIONS AND FUTURE RESEARCH

This study was confined to the northern region of Malaysia, and therefore, the findings from this study cannot be generalised to all manufacturing companies in Malaysia. Additionally, the survey response rate was low (26%), which may indicate non-response bias. Because the number was small, we could not perform a non-response bias test. Studies using larger sample sizes should be performed on all Malaysian manufacturing companies to evaluate whether the findings of this study truly reflect the reality. Second, we only used a single respondent within each organisation as our source of information. This may have resulted in some bias, but many researchers have argued that this bias is not a serious issue. Moreover, this study only focuses on inter-organisational relationships. However, SCM encompasses a spectrum of activities, both internally and externally. To have an effective supply chain, good internal collaboration is required in order to facilitate external collaboration. Future research should examine how both inter- and intra- collaboration impact supply chain performance. There are also many other variables which can influence supply chain performance. Thus, future research may include other variables identified in the literature to extend the model of research.

CONCLUSION

Currently, SCM has become the main focus of many organisations. SCM is viewed as an essential part of business success. Organisations should not isolate themselves if they want to compete in the marketplace. To survive, organisations must depend on support from the entire chain. Collaboration with the entire supply chain is critical to achieve a high level of supply chain performance. Based on the results of this study, relational factors were found to be positively related to supply chain performance. Hopefully, these findings will provide impetus for local companies to invest more on inter-organisational relationships in order to balance supply and demand at every supply node, for this is the key determinant of a successful supply chain.

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