

**THE USE OF INTERNET IN SUPPLIER SELECTION PROCESS AND
MANAGERIAL PERFORMANCE IN THE NORTHERN REGION OF
PENINSULAR MALAYSIA**

by

TONY LIM SWEE KING

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ABSTRAK

Sebagaimana yang diketahui, kos bahan mentah mengambil sebahagian besar jumlah kos produk. Sokongan daripada pembekal berkualiti amat penting agar sektor perindustrian dapat terus mempertahankan daya saingnya. Oleh yang demikian, staf pembelian memainkan peranan yang tidak kurang pentingnya dalam keputusan pemilihan pembekal. Dalam pada itu, internet sebagai sumber informasi dan komunikasi berjaya mengubah kaedah pengumpulan informasi strategik mengenai pembekal berpotensi supaya keputusan pemilihan yang terbaik dapat dicapai. Dengan itu, penyelidikan ini bertujuan untuk memahami hubungan antara penggunaan internet dalam proses pemilihan pembekal dan kesannya ke atas prestasi staf pembelian. Di samping itu, penyelidikan ini juga ingin mengkaji kesan penyederhana (moderating effect) kualiti informasi atas hubungan tersebut. Sebanyak 500 soal selidik berstruktur telah diedarkan melalui mel dan juga penghantaran secara terus kepada staf pembelian dari sektor pembuatan di sekitar kawasan utara Semenanjung Malaysia dan dalam pada itu cuma 183 set telah dikutip kembali. Keputusan penyelidikan ini mendedahkan bahawa kegunaan internet untuk penyelidikan utama dan komunikasi dalaman didapati mempengaruhi prestasi para pengurus. Kualiti informasi juga didapati mempunyai kesan langsung ke atas prestasi staf pembelian. Selain itu, kualiti informasi telah dibukti dapat menyederhanakan (moderating) hubungan antara kegunaan internet dan prestasi pengurus melalui penyelidikan utama dan komunikasi dalaman. Walaubagaimanapun, penyelidikan ini tidak mendapati kewujudan kesan kegunaan internet dalam komunikasi dengan pihak luaran atas prestasi para pengurus.

ABSTRACT

Cost of material is known to take up a major proportion of the total product cost. In order for manufacturing organizations to maintain competitiveness, having the good support from upstream suppliers is inevitably important. This has made the suppliers selection decision a critical task for purchasing personnel. Fortunately, the internet as an information-rich resource and inter-organizational communication tool, has transformed the way to garner strategic information about prospective suppliers before making the decision on desired partnership. Thus, the purpose of this study was to examine the relationship between the use of internet in supplier selection process and the ultimate impact on the managerial performance. This study is also aimed at examining the moderating effect of internet information on the relationship. A structured questionnaire has been sent out by mail and hand delivery to 500 purchasing personnel in manufacturing sector in the northern region of Peninsular Malaysia and only to find that 183 usable set of questionnaires returned. The result of this study revealed that internet use, in primary research and internal communication, and the quality of internet information itself had a direct effect on the performance of managers. Besides that, the moderating effect of quality of Information on the direct relationship was found to be significant when primary research and internal communication were involved. However, this study failed to prove that there is a positive relationship between external uses of internet for communication on managerial performance.

Chapter 1

INTRODUCTION

1.1 Background of the Study

Competitive Intelligence (CI), also known as business intelligence (BI), has been increasingly recognized as a vital ability in today's global digital economy. There are numerous versions of its definition outlined by academia, which can be sufficiently represented by "an analytical, systematic, and continuous process to gather, store, analyze, interpret; and disaggregate publicly held data into accurate, relevant as well as actionable information and knowledge about business partners, competitors; and general socio-political environment, before disseminating them for further strategic planning via legitimate, ethical means; and covert methodologies involving economic espionage" (Kahaner, 1996; Wright & Roy, 1999; Fitzpatrick, 2003). Competitive intelligence is particularly critical with the increased popularity of outsourcing and globalization that has made Supply Chain Management (SCM) an important part in strategic planning. Being a critical ingredient in SCM, supplier selection process calls for the capability to solicit data on prospective suppliers and to put them together into valuable and actionable decision, which in turn adds up to a form of CI. The possession of knowledge about supplier network and the ability to make fast and sound decision often constitute a competitive advantage as compared to competitors and other supply networks.

Purchasing is no longer viewed merely as a clerical function, but is increasingly recognized as a strategic contributor to the profitability and survival of business organizations (Pearson, Ellham, & Carter, 1996; Muralidharan, Anantharaman, & Deshmukh, 2002). For many manufacturing companies, the purchase of materials and

components make up one-half or more of total product cost (Billy & Grand, 1997; Jantan, Ramayah & Khaw, 2000; Muralidharan et al., 2002). This has been compounded by the increasing popularity of outsourcing, which further accelerates the importance of effective assessment and selection of suppliers. For these companies, the purchasing function supported by good information offer an additional avenue for achieving a competitive edge, besides having to focus on other cost saving efforts in areas like internal operations, product development, marketing, and other cost categories. Fortunately, the Internet supplies a plethora of information needed to assist in such decision making. Firms' competitiveness can be sustained by leveraging on tonnes of intelligence information from the Internet, which has transformed industry landscape and business structures (Malone, Yale & Benjamin, 1987; Porter & Millar, 1996; Fruhling & Digman, 2000). At times, however, it can be a case of "too much of a good thing." (Conor, 2001).

Internet has been evolving since World War II, from being merely a fallback plan for potential communication breakdown in the military to today's inseparable tool in public and business domain. According to Gupta and Tan (1999), Asia accounts for approximately 40% of the global Internet population, with China, India, and Korea accounting for a total of 168.2 million Internet users out of world wide population of 502 million users. Being a developing country, Malaysia has only around 1.9 million in the year of 1999 and the number has been growing at an exponential rate reaching another milestone of 8.7 million as of December 2003 with a 33% penetration rate (<http://www.internetworldstats.com/asia/my.htm>), which is slightly beyond Loo's (2002) prediction of 25% by 2005. Nonetheless, it is rather surprising to find quite a number of reports stating that high ranking executives do not believe in the need to read their own E-mail, let alone surf the net (Business week, Asian edition, 22 March

1999). This is backed by a survey on eight Asian countries which revealed a low degree of Internet usage for E-mailing (59%), searching for news/ current affair and company information (43%), technical queries/ software downloads (33%); and financial information/ data (26%) (Asiaweek, 21 July 2000). Brabston and McNamara (1998) narrowed down to three major reasons why top managers are reluctant to fully exploit the potential of Internet. First, is their unfamiliarity with the technology that leads to negative attitude for fearing to “break” the technology and this has been compounded by the perception that handling technology is too clerical in nature. The second reason is attributed to the difficulty in locating useful information from the Internet which is best described with the metaphor “of finding a needle in the haystack”. Finally, managers are loaded with tonnes of misrepresented and biased information, which are deliberately posted on the web to fabricate positive corporate image to the outside world. Unfortunately, these Internet usage patterns are found to be of critical importance in shaping competitive advantage in the supplier selection.

1.2 Problem Statement

Nowadays, more than ever, manufacturers encounter a growing pressure from customers who demand for greater responsiveness, manufacturing flexibility, quality enhancement, and product customization. At the same time, they also need to maintain lean inventory, shorten throughput time (TPT), and reduce production cost to ensure sustainable profitability. To strive for survival under these circumstances, more and more enterprises are resorting to establish long-term strategic partnership with a few competent suppliers (Tully, 1995) and collaborate with them in product development via early involvement, inventory control, and non-core activity outsourcing. Competitive advantage is, therefore, created by synergizing a company's

resources with that of others' in an unprecedented manner in order to drive down the firm's costs and to increase its earning (Barney, 1996). In this connection, the paradigm of business management has witnessed a dramatic transformation from competing as a sole autonomous entity to competing as a well-connected and integrated supply chain. The greater the dependence on suppliers, the more it calls for effective suppliers' management, which is underlined by three major dimensions: (a) effective supplier selection, (b) innovative supplier development strategy, and (c) pragmatic suppliers' performance evaluation mechanism (Kannan & Tan, 2002). Mohanty (1990) has identified that almost all material managers perceive supplier selection as the most important decision problem in today's competitive business environment. Hence, the most pressing business challenges is no other than living up to the swelling need to make fast, informed, and accurate purchasing decisions on a regular and almost unending basis.

Based on decision theory, quality of decision has a positive correlation with the amount of information considered when making it. This means that when more information is searched, reviewed, and used by procurement managers during the selection process, the greater the chances of making the right or optimal supplier choice. Both Graef (1997) and McGonagle and Vella (1998) concurred that 90% of all information, which is required to make critical decisions, is readily available and can be systematically reaped from public data. What are the sources of information that can be tapped in order to make better supplier selection decision? According to the Society of Competitive Intelligence Professionals (SCIP), there are 6 types of sources of Internet information, namely company home pages, trade association sites, academic sites, newsgroups, mail lists, and government repositories, that make it the largest repository for purchasing information. This information allows better

understanding of the market environment, business partners and competitors. Bits and pieces of public information can be wisely assembled together into invaluable pieces of CI information, which helps in supplier selection initiatives to source for the highest quality of input from well established suppliers at the lowest comparable cost.

It can, therefore, be summarized that the more the Internet is used to provide information for supplier selection, the more it is going to contribute towards the performance improvement. Thus, the problem statement is: Can the performance of procurement managers (making supplier selection decision) be improved through the use of information that is garnered from the Internet?

1.3 Research Objective

Past researches have focused on the study of the supplier selection criteria, the intention to adopt information technology, and perhaps their impact on organizational performance as a discrete study. No published or unpublished work is known to have examined the use of the Internet in supplier selection and its subsequent effect on managerial performance. Rahman (2004) identified procurement activities being among the few major uses of the Internet in SCM on the basis of the expenditure made to support them. This leads to the interest of investigating the extent of Internet use amongst Malaysian procurement personnel in supplier selection activities and its subsequent impact on the variation of their performance. This study also seeks to find the moderating effect of the quality of Web-based information on the above relationship.

This study focuses on the procurement and purchasing personnel when meeting the following objectives:

- (1) To explore the relationship between the extent of Internet usage, in terms of (a) research, (b) internal usage, and (c) external usage on the performance of procurement managers, in which supplier performance is to serve as proxy.
- (2) To explore the moderating effect of the quality of suppliers' information on the relationship between extent of Internet usage in purchasing activities and managerial performance.

1.4 Research Questions

Given the objectives outlined above, this study attempts to answer the following research questions:

- (1) Does the extent of Internet CI used by procurement managers affect their performance?
- (2) Does the quality of information posted on the Internet by suppliers, moderates the relationship between the extent of Internet CI in purchasing activities and procurement managers' performance?

1.5 Significance of the Study

Despite a large volume of research conducted in the area of supplier selection and its impact on profitability (Vonderembse & Tracey, 1999), little attempt has been made to identify the impact of using the Internet in enhancing procurement effectiveness (Cockburn & Wilson, 1996; Bakos & Nault, 1997). Hence, this study hopes to bridge the gap and also to make a contribution in this field of study. It is hoped that the results of this study will create a better understanding of the extent of Internet usage in supplier selection process among procurement managers in Malaysian manufacturing companies and also its subsequent impact on managerial performance

enhancement. The insight into this relationship is of critical importance to demonstrate the readiness among Malaysian companies to further leverage on Internet to expand and to broaden strategic decision making in other business functions.

Like it or not, the Internet is undeniably influencing the effectiveness of our daily lives and also the way we conduct business. By gaining some insight via this research, the authorities can devise a set of pragmatic strategies to equip Malaysian procurement managers with astute computer skills and to instill them with the right mindset towards technology, so that the right atmosphere could be set for them to compete internationally by leveraging the Internet for more CI creation. In addition, this proposed study is also aiming to be a stepping stone for future researches in further exploring the field of CI in Malaysian context.

1.6 Organization of Remaining Chapters

Chapter 2 presents the literature review on Internet usage, quality of information secured from Internet and suppliers performance using the Supply Chain Operation Reference (SCOR) model. This is followed by the discussion on model framework and hypotheses generation. Chapter 3 presents the methodology proposed for this research, questionnaire design, measurement development, data collection method and statistical analysis. Chapter 4 presents a summary of the findings, statistical results, and relationship between variables. Chapter 5 concludes the research with the discussion of the results, implications, limitations, and suggestions for future research.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

The intense global business competition has dramatically changed the business landscape and made it harder for enterprises to remain self-sufficient in a turbulent and changing environment that calls for focus and flexibility (Crossan & Inkpen, 1995). Porter (1985), Lee, & Billington (1992); and Mohr & Spekman (1994) concurred that strategic alliance has to be in place for organizations to achieve long term competitive advantage. Companies are no longer fighting among themselves autonomously, but the competition is rather in the form of supply chain against other supply chains (Vickery, Calantone, & Droge, 1999; Johnson & Pyke, 2000). Hence, SCM is now a common philosophy and practice in the business world, and gains a tremendous amount of attention from both academics and practitioners.

SCM is a multi-business network that spans across organizational boundaries that coordinates order processing, manufacturing, inventory controlling, and logistics to ensure a smooth transformation of value-added goods as well as services right from the suppliers' suppliers to the customers' customers (Stephens, 2001; Svensson, 2002). It treats all the organizations in the value chain as a unified virtual business entity (Scott & Westbrook, 1991; New & Payne, 1995; Laudon & Laudon, 2001). Therefore, the selection of suppliers has become critical for several reasons. First, the increasing trend towards "just-in-time" manufacturing practices has resulted in a supply base reduction (Pearson & Ellram, 1995). Second, owing to resource scarcity, there is a need for greater interaction between the buyer and the supplier. Third, many

firms involve their suppliers early in the planning process so that they are able to deliver superior value to their customers (Trent & Monczka, 1998).

In view of that, supplier selection and performance assessment become very important particularly when the dependency on their upstream partners becomes even greater (Kannan & Tan, 2002). Carter and Narasimham (1990) introduced several steps in supplier selection procedures. In this six-phase model, phase I is the pre-selection procedure that helps to crystallize the purchase needs and requirements before sending out a request for quotation (RFQ). This is to achieve better alignment with the overall strategic objectives. Phase II and III fall under the supplier selection phase whereby potential sources are identified and analyzed before further shortlisting is commenced. Phase IV is the best supplier selection phase through which quotes are received and evaluated to filter only the best from a list of qualified suppliers. The last two phases (phase V and VI) are basically about performance evaluation and relationship maintenance of the selected suppliers. The six-phase model is shown in table 2.1.

Being one of the competitive sources in Porter's Five Competitive Forces Model, making full use of the distinctive knowledge about its suppliers, in both short- and long-term strategic planning, can definitely help an organization stay one step ahead of its competitors and thus gain competitive advantages (Fuld, 1995; Brockhoff, 1998). Integrating information from environmental assessment and competitive monitoring has been repeatedly found in many researches to be instrumental to decision making process, company's performance and effectiveness (Miller & Friesen, 1977; Daft, Sorumunen, & Parks, 1988; Leow, 1993; Haynes, Becherer & Helms, 1998; Subramanian & Ishak, 1998).

Table 2.1:

6-phase model of supplier selection procedure (source: Carter and Narasimham, 1990)

Phase	Steps
I	1. Definition of needs
	2. Review purchase requisition
	3. Prepare RFQ
II	1. Source and product identification
	2. Locate potential sources.
	3. Decision to buy
III	1. Suppliers evaluation
	2. List qualified suppliers
	3. Re-evaluation of qualified supplier list
IV	1. Analyze suppliers quotes
	2. Quote includes necessary information?
	3. Perform comparison analysis
	4. Rank order suppliers
	5. Prepare final list
V	1. Analyze subjective issues
	2. Perform final comparison
	3. Select supplier
	4. Negotiate price and terms
	5. Place the order
VI	1. Manage the contract

Fortunately, the common protocol coding of multimedia Internet has made supplier selection activities so much more user friendly and intuitive even to procurement managers who might be an amateurs in using the Internet. Despite the challenge of having lesser research resources, smaller firms' managers can gain equal capabilities and resources to compete with bigger rivals in engaging top notch suppliers with the help of Internet to effectively search, communicate, and disseminate CI information (Graef, 1996; Poynder, 1998). Several studies have also shown that information solicited through the Internet had positive effects on the quality and time required for operative planning and managerial decisions (Teo & Choo, 2001; Hannula & Pirttimaki, 2003). Thus, it is believed that procurement managers' effectiveness and performance will be boosted by basing their decisions

and actions on superior quality of suppliers' information gathered through the Internet.

2.2 Managerial Performance

Measuring performance can be defined as transferring and quantifying the complex reality of performance, in terms of effectiveness of action, into symbols that can be communicated and reproduced under similar circumstances (Lebas, 1995). Basically, organizational strategic benefits attained through leveraging on valuable CI resources, like distinctive suppliers' information, can be measured in terms of revenue generation, cost reduction, and managerial effectiveness (Wright, 1993; Teo & Choo, 2001). The effectiveness of procurement managers in making a quality supplier selection decision is a prerequisite to pursue supply chain excellence. According to Masella and Rangone (2000), "supplier selection is one of the purchasing manager's most critical tasks". The performance of the chosen suppliers represents part of the key performance indicator (KPI) for the procurement managers who make the decision. Thus, the performance level of suppliers is deemed fit to serve as proxy to appraise the procurement managers' performance in evaluating and deciding on the desired partnership via the use of information posted on the Web. This assessment is found to be necessary in driving for continuous check and improvement when marching towards supply chain excellence (Chan & Qi, 2003).

As claimed by Sink and Tuttle (1989) "you cannot manage what you cannot measure", and perhaps partly in response to this, a slow but increasing amount of research interest is intrigued in the modeling of SCM performance measurement. Researches have been conducted to identify various selection criteria (Dickson, 1966; Lehmann & O'Shaughnessy, 1982) used under different buying conditions (White,

1978; Dempsey, 1978; Johnson, 1981; Ellram, 1990; Swift, 1995) and their consistency in perceived importance among buyers (Verma & Pullman, 1998). These *ex ante* selection assessment will later serve as the yardstick for measuring the suppliers' performance. Quantifiable or 'hard' criteria such as price, delivery, quality, and service are normally used for supplier selection and assessment (Ellram, 1990; Hahn, Watt & Lim., 1990). "Soft" or qualitative factors like compatibility of strategic and management styles have also been shown to be vital in forming strategic partnership (Ellram, 1990). Delivery performance, cost, and quality have also been recognized as being the crucial measures of suppliers' performance.

The greatest challenge related to SCM performance assessment has to do with getting the measurement to focus not only on the individual link in the chain but on the performance of the entire supply chain (Van Hoek, 1998; Beamon, 1999). This is because a single SCM performance measure is not comprehensive enough where it ignores the interactions among important supply chain characteristics and critical aspects of organizational strategic goals. These goals cover elements that measure resources, output, and flexibility. More often than not, researchers have failed to render a balanced performance measurement whereby they focus too much either on financial measurements or on operational measurements (Kaplan & Norton, 1992). Thus, Stephens (2001) espoused for the need to have a holistic approach to improve our understanding of supply chain performance in view of the inadequacy of solely depending on financial performance appraisal (Barker, 1995).

Beamon (1999), and Chan and Qi (2003) (in Thoo, 2004) classified the multi-dimensional performance measure into both qualitative and quantitative when measuring different facets like customers satisfaction, responsiveness, flexibility, supplier performance, and cost. On top of that, other researchers like Gunasekaran,

Patel, and Triroglu (2001) segregated the performance matrix into three main levels, namely strategic, tactical, and operational and evaluated them along with the four major decision areas-plan, source, make, and deliver-identified in SCOR as a fully integrated supply chain instead of a stand-alone, local entity. These measurements are necessary to facilitate the integration of supply chain members where managers can monitor performance and progress, enhance motivation and communication, and diagnose problems (Rolstandas, 1995; Waggoner, Neely & Kennerley, 1999).

In measuring suppliers' performance, this research adopts Thoo's (2004) SCM performance assessment model, which in turn was based on SCOR model developed by Supply Chain Council (SCC) (Stephens, 2001). SCOR is a business process reference model that provides a standard process definition and links each of the process elements to performance metrics, best-in-class practices, and technologies for the ease of communication within supply chain (Reichardt & Nichols, 2003). SCOR Model illustrates supply chain performance in five dimensions: reliability, responsiveness, flexibility, cost, and efficiency in asset utilization. Adaptation is made to the SCOR model by focusing on reliability, responsiveness, flexibility, and cost. Efficiency in asset utilization is dropped since the focus of this study is targeted on suppliers' performance from the perspective of a buyer, rather than on the entire supply chain. There are a large number of factors influencing the efficiency of asset utilization in the buying firms, and the one that is related to suppliers' performance has been covered by reliability construct since the buying firm's main concern is the reliability of a committed delivery date when strategizing its production and inventory level.

2.2.1 Reliability

Based on the level 1 attribute definition delineated in SCOR, reliability refers to suppliers' performance in delivering (a) the right product, (b) in the stipulated quantity, (c) to the right customer and destination, (d) at the correct timing, (e) in the precise condition and packaging, (f) with the correct documentation (Stephen, 2001 in Thoo, 2004). Because of the direct interaction with customers, delivery-to-commit date has become so imperative until being known as the driver of customer satisfaction (Stewart, 1995). When suppliers constantly live up to Just-in Time (JIT) delivery, the buying firm can achieve greater-than-industry-average on inventory turnover as a result of keeping a lower-than-average inventory.

Product quality is another area where reliability comes to the fore. The chosen suppliers are expected to be able to consistently sustain the level of quality they promise in their offerings. One of the FedEx success factors is its uncompromised capability to meet its overnight delivery commitment and to provide the convenience to its customers by allowing users access to its tracking system through their Web site. The remarkably popular site allows the customers to trace their shipment status by simply typing in the package receipt number into the Web based system. In September 1995, there were 168,000 customers who tracked packages on the site, whose activity increases by about 30 percent monthly. "The Web is one of the best customer relationship tools ever", according to FedEx managers (U.S. News and World Report, 1995).

2.2.2 Responsiveness

Responsiveness relates to the speed at which supply chain supplies the product offerings to its customers. Beamon (1999) called this as output measure of supply

chain which is represented by the time required to produce a particular set of items (manufacturing lead time) and the number of backorders. Responsiveness is also represented by the response time required to attend to a customer's inquiry and to turn orders into deliveries (fill rate). This is incorporated into the calculation of the order lead-time, which refers to the time elapses between the receipt of the customers order and the delivery of goods. According to Kannan and Tan (2002), responsiveness also correlates to a quick response time in the case of emergency, problem, or special request. A reduction in the supply chain response time denotes a source of competitive advantage (Bower & Hout, 1988; Christopher, 1992) since it directly influences the customer satisfaction level (Towill, 1997).

2.2.3 Flexibility

Flexibility measures how agile the chosen suppliers are in swiftly reacting to the changes that are imposed by their suppliers, customers, and manufacturing variations. Flexibility can be viewed from different angles, whereby it can take the form of either volume flexibility or variety flexibility (Beckman, 1990). The former refers to the selling firm's capability to handle changes at short notice to increase output, while the latter represents the ability of suppliers to switch between a variety of models with small-batch production, minimum lead time, and conversion cost. Procurement managers have to wisely select those suppliers who have the flexibility to absorb demand fluctuations as well as execution variations to reduce the number of backorders, sales lost, and late orders (Beamon, 1999). Reduction in purchasing firms' overhead costs and time-to-market for new product introduction also depend on the suppliers' capability to do small-batch turn around (Lee et al., 2003). Uncertainty entails flexibility and this constitutes the core competency of a contemporary

company (Stalk & Hout, 1990; Blackburn, 1991) as it is found to be the right recipe to win and retain different segment of customers with diverse needs (Novich, 1990; Gunasekaran et al., 2001).

2.2.4 Cost

Even though financial performance measurement may not be adequate in appraising efficiency, but throughout history, monetary measurement has been used as a legitimate and standard unit of measurement for reporting performance. Hence, cost is still the major concern when evaluating the right suppliers. The cost of purchase charged by the supplier encompasses the cost of (a) direct materials, (b) order processing, (c) transportation and distribution, (d) machine and manufacturing hours, and (e) storage and inventory holdings. A rational decision maker always tries to source for the best buy at the lowest possible cost. Hence, the optimal choice of supplier is made after multiple points of view are assessed, including complementing and conflicting information. This is called “best practice” approach (discovery approach) proposed by Nutt (2002) to derive not the best but the optimal outcome.

The Internet creates a database to enable large numbers of firms to advertise their products, services, and expertise for the entire user base of the network (Barua, Ravindran, & Whinston, 1997). Searching on the web repository may uncover a large pool of qualified suppliers at a marginal search cost. A large number of alternatives may be desirable to the extent that it allows the buyer to take the advantage of wider range of choices when making the best supplier selection decision.

2.3 Internet Usage

In a survey assessing Internet usage, Lancioni, Smith, and Oliva (2000) found that over 90% of the respondents used the Internet in some part of their supply chain management program. Internet is generally used for research, external, and internal communication of CI information on prospective suppliers.

2.3.1 Research

When doing investigation on Internet usage as a tool for industrial purchasing, Kennedy and Deeter-Schmelz (2001) found that most buyers were using the Internet for gathering information and placing routine orders. They also discovered that the Internet seemed to be more useful as an information-gathering tool than as an online transactional tool. With that, research through the Internet can be further broken down into two sub dimensions, namely primary and secondary research.

Primary research is defined as the collection of fresh, first hand data, which serves a very specific set of purpose that the researcher intends to explore. Richard (1996) believed that company profile can offer an accurate and timely insight into the business information which is critical in making an educated decision.

The Internet is commonly used in primary studies as a result of its intuitive interface. In a study on the content and future trend of Fortune 500 companies' homepage, Liu, Arnett, Capella, and Beatty (1997) found that over 93.2% of the companies displayed products and services, 86.1% provided companies' overview, 79.3% presented interactive feedback while 71.1% introduced new offerings. With that, Internet has been discovered to be the primary information source for businesses to track changes in industry landscape (Auger & Gallagher, 1997). Information about product varieties and innovations assists the buying firms to strategize the

selection of right supply partner (Fisher, 1997). Watching over the job posting at suppliers' homepage is another tactic to comb for details about staffing levels and recruitment activities, which leads to the skills, strategic resources, and talents they are developing and offering. This piece of information cannot be completely concealed from a skilled reader by analyzing the job description being advertised (Wayner, 2001).

The use of Internet in primary research for prospective suppliers is not mutually exclusive to the secondary research as the latter serves as the cost efficient supplementary source of information in area of interest which may not be viable through the primary research (Teo and Choo, 2001). Internet is also being tapped for CI information by mining the pool of knowledge from secondary data like conferences, scholastic journals, technical white papers, discussion groups, homepage, e-newspapers, press releases; and many other resources which are readily identifiable on the Internet (Kassler, 1997).

Routine corporate filings, like financial reporting, expansion proposals, and patents, mandated by government agency constitute a wealth of competitive information. This information is easily available by simply filling a Freedom of Information Request through the Internet that leads purchasing companies to a wide range of CI information on targeted supplying firms (Fuld, 1995; Fitzpatrick, 2003; Kahaner, 1996). Meanwhile, periodic publications on governmental websites contain a great deal of suppliers' data, which can be useful in gauging the new technology, market condition, and cost structure. Brabston and McNamara (1998) went into great detail to delineate various websites that offer socio-demographical, technological, economical, and political secondary data for the State.

Besides having to scout for data, companies can actually turn to CI professionals, like Lexis-Nexis, Hoover's Online, and many others, who have set up both free as well as pay sites on the Internet to allow companies to make use of the focused suppliers and industrial information. Electronic brokerage also plays a significant role in "matchmaking" of both suppliers and customers. Online auction is another new horizon where a firm can explore by posting a request for quotation for the ingredients necessary to manufacture their offerings.

2.3.2 Internal Dimension

Internal use of Internet for supplier selection activities comprises of internal collaboration and dissemination of critical CI information (Teo & Choo, 2001). Davidrajuh (2003) reported that supplier selection process involved people at several authority levels (vertical involvement) and across several departments (lateral involvement) besides the purchasing department itself. The Internet offers practical tools for business communication, such as e-mails, newsgroups, remote access, and file transfers. It brings down barriers to communication amongst employees by removing the obstacle created by time zones and geographical difference, forming a friction-free business environment.

Murgolo-Poore, Pitt, Berthon, and Prendegast (2003) asserted that internal network facilitated communication and collaboration that enhanced the accessibility to vital information resources from one's desktop. CI information (e.g., strategic supplier analysis), which normally goes in great detail and complexity, was found to be more effective and economical to be exchanged via Internet (e.g., email) across various stakeholders. This is to allow all the relevant functional and support groups to get calibrated through timely cascading and transforming the critical information into a

valuable action plan on an ongoing basis (De Bussy, Watson, Pitt, & Ewing, 2000; Murgolo-Poore et al., 2003). In a study on the impact of Internet usage on managers' work life, Gan, Kiong, Koh, and Wong (2002) found that the respondents have a myopic view on Worldwide Web (WWW) by making a lucid distinction between the Internet and E-mail. In that research, Internet was mainly associated with E-commerce and found to be irrelevant in enhancing the manager's efficiency. Another study by Feher and Towell's (1997) concluded that E-mail is currently the primary usage of Internet and this trend is expected to continue. This is in accord with Gan et al.'s (2002) finding, where E-mail was reported to be capable of enhancing effectiveness.

Nevertheless, the internal purpose of Internet in the context of this research encompasses the extent of e-mail, Intranet, and Internet being used for upward and downward communication and information sharing amongst all relevant internal players.

2.3.3 External Dimension

Eng (1995) found that much of WWW activities were in the form of external communication. The external use of Internet in the supplier selection involves collaborating and disseminating valuable information with external business partners, customers as well as consultants. This is to enable the establishment of mutual understanding on the common goals that not only foster a more meaningful and closer relationship but eventually lead to greater mutual benefits. Merritt (2001) reported that the President of GENCO once said that exchange of information was as critical as distributing physical products and will help to fuel the efficiency throughout the supply chain. The integration of E-mail and interactive applications based on Internet

facilitates two-way communication between actors which was not feasible with traditional broadcasting media, like trade journals and printed business directories (Barua et al., 1997). The medium possesses what Blattberg and Deighton (1991) termed as interactivity-the facility for individuals and organizations to communicate directly with one another regardless of distance or time. Such one-to-one interactions successfully nurture a strong and sustainable partnership from the beginning of the relationship. Such a strong bond engenders trust that will eventually lend itself to higher SCM performance (Thoo, 2004).

According to Malone, Yale, and Benjamin (1989), exchanging products and services through electronic platform will result in three major effects: electronic communication, electronic brokerage, and electronic integration. The Internet increases the richness of communications through greater interactivity between the buying firms and the suppliers, which helps to develop the familiarity and expertise required for each partner to know when and how to draw on and to contribute to each other's resources. The dawn of Internet-based Electronic Data Interchange (EDI) has unprecedentedly allowed and helped in preparing the companies to be more open in exchanging a vast scale of data among geographically dispersed organizations in a cost efficient manner. Hence, the effectiveness in managing the international operation has been significantly boosted (Lancioni, Smith, & Schau, 2003).

Through the consortium of trading network called RosettaNet, the world's leading Information Technology (IT), Electronic Components (EC), Semiconductor Manufacturing (SM), and Solution Provider (SP) companies exploit on Partner Interface Processes (PIPs), a specialized system-to-system Extensible Markup Language (XML)-based dialog, which defines business processes between trading partners. This facility accelerates B2B integration via industry implementation efforts

for XML standards and emerging services. By forming a common architectural platform, organizations along the supply chain will drive for joint development of B2B standards supporting multiple industries. The involvement of buying firms' customers into the early selection process serves as the catalyst to speed up and increase the number of implementations across user communities. The spillover effect is created through the attraction and the cooperation from adjacent industries on a worldwide basis.

During the inauguration of the development phase of the 777 project, Boeing created synergy from using Internet based technology to disseminate the blue prints, design architecture and material decisions with diverse design team members and suppliers from various countries (Kezsbom & Deborah, 2000). External communication facilitated by Internet is very important to assist in resolving disputes and in aligning expectations (Morgan & Hunt, 1994; Fynes & Voss, 2002).

The value of Internet information lies in its usefulness to assist in making sound and quality decisions. Diligently using misrepresented information for decision making can only guarantee failure as it is equivalent to what Covey (1989) said "industriously climbing the ladder and only to find that it is leaning against the wrong wall". That was one of the reasons managers were found to be reluctant in using information from the Web as it could be deliberately fabricated to create a utopian image to the outside world (Brabston & McNamara, 1998). Thus, commanding large amount of information with superior quality is a supplement to quality decision making.

2.4 Quality of Information

Information is a meaningful arrangement of data that creates patterns and activates meanings. The cost associated with using poor quality data to make poor decisions is rather high. Consequently, the management of data quality and the quality of data management processes has become critical for organizations.

Data quality can be measured along several different quality dimensions. Davis and Olson (1985) identified three aspects of data quality, namely accuracy, precision, and completeness. Huh, Keller, Redman, and Watkin (1990) and Fox, Levitin, and Redman (1993) went on to recognize four dimensions of data quality: accuracy, completeness, consistency, and currency. After analyzing on defective data in organizational database, Madnick and Wang (1992) found an additional property, i.e. *appropriateness* to supplement the four dimensions of data quality mentioned above. Wand and Wang (1996) postulated that data quality is task-independent and found four dimensions of data quality: completeness, lack of ambiguity, meaningfulness, and correctness. Wang and Strong (1996) extended the research in this area and developed a 20-dimension data quality framework from the perspective of information user.

In view of applying Wang and Strong's (1996) 20-dimension could be too unwieldy in practice; the quality of suppliers' information solicited through the Internet could be adequately measured using seven quality dimensions. Thus, this research adopted the model used by Teo and Choo (2001) in measuring information quality, who combined the empirical measurements collated by Gallagher (1974), Bailey and Pearson (1983); and DeLone and McLean (1992). These seven data

quality characteristics are (a) accuracy, (b) completeness, (c) currency, (d) relevance, (e) timeliness (f) understandability; and (g) ease of accessing the net information.

Accuracy, reliability, and completeness ensure precise representation of factual information and its sources are clearly listed, so that they can be verified against other sources. Timeliness, currency, and relevance are indicators measuring whether materials placed on web page are constantly revised and kept current, to guarantee decision makers are being furnished with the latest and most useful information. Important information, like company's products, must be described with an adequate level of detail in order to be useful and understandable to the targeted audiences.

2.5 Research Model

Since 1950, decision theory has become one of the most influential models and it is still widely used in several fields like economics, statistics, psychology and engineering (de Almeida & Bohoris, 1995). There are three main streams of decision theory, namely normative decision theory, behavioral decision theory, and naturalistic decision theory (Lye, Shao, Rundle-Thiele, & Fausnaugh, 2004). All decision making methods were developed around uncertainty in changing condition and “naturalistic decision theory approaches decision making from process and outcome perspective” (Lye et al., 2004). It begins with situation assessment pertaining to the emerging condition in order to derive several alternatives to a decision. Thus, gathering sufficient information is critical in supporting decision making process. Benson & Dresdow (2003) outlined seven failed decision traps, out of which limited searching had been identified as one of the failure factors. Pressure for quick fix undermines the