Understanding the Role of B2B Social and Relational Factors on Web-Based EDI Adoption - A collaborative approach in the container liner shipping industry

By

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Declaration of Authorship

I Cheng-Yun Yang hereby declare that this thesis and the work presented in its entirely my own. Were I have consulted the work of others, this is always clearly stated.

Signed:

Date:

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Abstract

Organisations today operate in a complex, unpredictable, globalised, and competitive business environment and challenging marketplace, emphasis on just-in-time deliveries and service quality through the integration of resources. In response to the changing business dynamics, web-based EDI (WEDI) has been adopted by the global container shipping industry to cost-effectively utilise available resources to build and remain its competitive advantage. To improve the current understanding of WEDI adoption factors, this research explores inter-organisational collaboration of WEDI adoption, focusing on the organisational adoption stage and examine how business level social and relational factors influence WEDI adoption in the context of the container liner shipping industry.

Based on theoretical and literature reviews on previous EDI adoption, in particular to three key inter-organisational system adoption empirical research (including Lee and Lim, 2005; Boonstra and de Vries, 2005; Zhu *et al.,* 2006), an integrated research model was established of which features 'Social Resources' of (trading *partner power, trading partner dependence and social network effect*), 'Relational Resources' of (*trading partner trust, top management commitment* and *guanxi,* 'Reward' of (*perceived interests*), and 'Technological State' of (*technological trust* and *e-readiness*) as prominent antecedents.

Through E-mail and Web Survey approach, we examine the nine independent constructs in the research model quantitatively on a dataset of 164 respondents from the top 20 leading container shipping liner in year 2009 and 195 respondents of the top 20 leading container shipping liner in 2012 by 3 case studies through online surveys. After examining its reliability, validity and correlation of the constructs, PLS structural Equation Modelling was applied to test hypotheses.

The empirical results update how firms exchange business dada, in particular to the use of WEDI in the industry. This study demonstrated that 'Social Resources' of *trading partner power, trust* and *guanxi*, positively associated with the *perceived interest* of WEDI adoption. Relational Resources' of *trading partner trust, top management commitment* and *guanxi* positively associated with the *perceived interest* of WEDI adoption. It also

confirms the nine constructs to be positively association the WEDI adoption decisions. Drawing upon social exchange theory, we argue that firms simultaneously modify and adjust their social and relational resources to affect other firms' *expected benefit* as a reward.

Overall, based on a rigorous empirical analysis of two different international dataset, this research provides valuable and the most updated insights into a set of key factors that influence WEDI adoption. By recognising what may influence WEDI adoption in the context of the container liner shipping, this study will be useful in suggesting strategies to overcome the constraints that inhibit adoption. Researchers will benefit from the study's theoretical insights and explore further WEDI adoption and diffusion patterns. Practitioners who learn why organisations adopt WEDI and what the related factors are that influence the adoption process will make better strategic decisions concerning the adoption of WEDI.

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Chapter 1

Introduction

1.1 Background to the Study

Organisations today operate in a complex, unpredictable, globalised, and competitive business environment (Chan *et al.,* 2012). Issues such as economic slowdown of the global market, a gradual shift in the demand from the traditional mature markets towards new emerging markets, continuous cost rising and the consequent diminishing revenues are weighing down growth prospects of the business. The rapidly changing competitive landscape, characterised by intense competition, uncertainty of the market demand, and blurred industry boundaries is driving businesses to be more efficient than ever before (in order to survive and compete with others). The growing trend of electronic commerce has been forcing manufacturers and retailers to shorten the product cycles, delivery time, increasing the pressure to cut costs as well as to create innovations.

In response to the changing business dynamics, more businesses are now using the Internet to streamline their supply and distribution chains, reengineer business processes, enrich customer interactions and provide cost-effective and value-added services. Web-based technology facilitates information management and enhances information flow, thereby making the supply chain more robust and resilient without undermining its efficiency (Pereira, 2009). As a ubiquitous, cost-effective business medium, the emergence of the Internet has fundamentally changed the way companies transact, communicate, acquire and utilise resources in building or sustaining competitive edge. In the 1990s, organisations have been moving towards the adoption of the business-to-business (B2B) technologies that allow them to integrate their supply chain processes better. From approximately the year 2000 onwards, organisations have started to move towards using collaborative commerce tools through Internet in the supply chain to create and maintain an interactive business community of employees, trading partners, suppliers and customers (Chong *et al.*, 2009). Consequently, the condition for a more collaborative technology adoption (such as, web-based EDI) in the supply-chain related activity seems to be emerging since.

Unlike most companies used to focus on improving internal efficiency and internal business process in the 1980s and 1990s, the competitive dynamics of the current environment, coupled with advances in web technologies are forcing business to look beyond corporate boundaries into the realm of supply chain networks to create distinct value propositions and added efficiencies (Ranganathan *et al*., 2011). Through Internet network, organisations have responded to these challenges by implementing collaborative supply chain management (SCM) to integrate business processes, enable the sharing of information among electronic supply chain members, which allows their organisations compete better with their business rivals. One of the most commonly adopted information technologies that aim to integrate the electronic supply chain processes is Electronic Data Interchange (EDI).

In fact, the container liner industry is among the first to utilise the concept of cooperative behaviour in the quest for achieving particular business objectives (Panayides and Wiedmer, 2011) since the industry is largely associated with the need for risk and investment sharing, economies of scales, cost-control, and the capability to increase service frequencies (Midoro and Pitto, 2000). This cooperative behaviour in the liner shipping industry has a historic origin dating back to the 1870s when ocean shipping companies formed the first cooperative agreement in an effort to eliminate cut-throat competition by limiting capacity and fixing prices.

Until more recently, the new forces of the global market, particularly the protracted poor profitability of most container carriers, have been calling for an even closer cooperation in the economy reflected in today's cooperative behaviour - the formation of global strategic alliances at the end of 1995 (Tyan *et al*., 2003). This includes the vertical integration of transportation operations; the main activity also comprises the horizontal agreement for sharing fleet and route services (Lu *et al.*, 2006).

Therefore, the importance of the relational collaboration between the container liner shipping's supply chains today challenge researchers to extend theories by providing a more complex phenomenon to understand since there are significant degrees of economic and political power on the supply and procurement sides that dominates the

supply chain relationship. In addition, radical changes in recent year's supplier–customer relationships have let organisations begin to emphasise a closer supplier–customer relationship to create and seek for more efficient/ effective operations.

Such close relationships may offer greater collective advantages; the increased closeness in the relationships creates the basis for the simplest form of supply chain. Since a single member of the supply chain alone cannot do much to resolve the supply chain problems, that is why collaboration among trading partners in a supply chain has become a topic of great interest for many - an essential element of company strategy, making collaborative relationships becomes the focal point recently in the modern supply chain (Bahinipati *et al.*, 2009) in both the number of academic publications and the diversity of management aspects being promoted in this area (Holweg *et al.*, 2005).

Over the years, firms have implemented several strategies to improve effectiveness and to enhance efficiencies through the use of inter-organisational systems (IOS), such as EDI. By adopting EDI between trading partners along the supply chain, the use of electronic means to exchange information and conduct business transactions within and across organisational boundaries allows organisations to quickly identify consumers' requirements and trends and subsequently communicate the gathered information throughout the supply chain effectively.

Being regarded as one of the primary enabling technologies for business-to-business (B2B) transactions, EDI has significantly changed the way business is conducted, making a major impact on many industries over the past few decades. By allowing standardised electronic communication of business information with trading partners across organisational borders, EDI permits organisations to generate electronic purchase orders, invoices, bills of lading, and a variety of other documents and sends them instantly to trading partners anywhere in the world. The reduction in communications, labour, and material costs, improved accuracy, enabling business process reengineering, supporting industry value chain integration initiatives (such as demand-driven just-in-time inventory system), gaining competitive advantage among the reported benefits of an EDI environment (Iacovou *et al.*, 1995). However, with the emergence of the Internet/web technology, and

the major challenges to the use of traditional EDI include the availability of different types of standard in EDI, unable to provide real time data transfer and the associated high sunk cost (Chong and Ooi, 2008), it appears that traditional EDI potentially could be replaced by web-based EDI adoption.

Therefore, EDI had, in general, redefined organisational boundaries, creating more dynamic inter-organisational relationships between the EDI trading partners, and, in particular, enabling firms to build up a more cooperative electronic network relationship. This relational function of EDI constitutes an 'extended enterprise' in the entire business network through the electronic flows of information across the supply chain (Teo *et al.,* 2003) that altered the way market behaves, the way of doing business, and left few industries unchanged (Howard *et al*., 2006). By leveraging the open nature of the Internet to improve firms' agility and competitiveness, EDI has been changing rapidly to an Internet/web-based format from the traditional EDI. As a result, Internet/web-based EDI systems increase transactional precision among businesses, increase information transfer speed through simplified work processes, and greater productivity and work efficiency. Increasing number of firms appear to turn to the more cost-effective and flexible web-based approaches that capitalise on many-to-many relationships within today's digital economy (Elgarah *et al.*, 2005).

Through the open system architectures and standards, like the Internet's Transmission Control Protocol / Internet Protocol (TCP/IP), web/internet-based EDI appears to be a set of accurate, low-cost techniques, tools, and services. This allows organisations to conduct business with its existing or future trading partners cost-effectively through Internet, reserving a higher flexibility and scalability in a manner more powerful than traditional EDI. By eliminating many technical, geographic and cost barriers obstructing the global flow of information, new efficiencies and new relationships between enterprises have been created among its customers, suppliers and distributors (Laudon and Laudon, 2004).

Through Internet, web/internet-based EDI also strengthens firms' global competitiveness and obtains wider sustainable gains from suppliers, and other business partners. By using this emerging trend that encourage the migration towards an open standard

inter-organisational system (Zhu *et al.*, 2006), it indicates the need to understand the cooperative nature of Internet/web-based EDI, in particular, to better understand of the complex inter-organisational relationships in the age of the electronic relationship.

Previously, many researches focus on studying the impact of traditional EDI on efficiency, effectiveness, industry/ organisational structure, and management. These past studies have developed theories in the field of traditional EDI. Although the relevant literature and case studies on web-based EDI are scarce, the adoption, applications and impacts of web/Internet-based EDI are topics worthy of further investigation in order to better understand the complex nature of its open and inter-connected digital network relationship. Consequently, it is believed that by changing the increasing complex nature of business relationships, the potential of the value creation through extended enterprise relationships (via web/Internet-based EDI) could be leveraged for pursuing new opportunities and also to better adopt to the market changes (Kopczak and Johnson, 2003; Malhotra *et al*., 2005).

From an academic perspective, there has been a rich and growing body of research focus on cooperative relationships in business markets. Researchers have provided many insights into the nature and mechanisms of supply chain relationships and developed conceptual frameworks and integrated models of business-to-business interactions (Wilson, 1995). Both marketing and management scholars have investigated a wide variety of relationship-relevant characteristics since the beginning of 1990s, (Cannon and Perreault, 1999; Hewett *et al*., 2002), witnessing a growing interest in relationships. For instance, in marketing, the term relationship marketing has become an important source of competitive advantage, a new marketing paradigm shift from transactional (short-term) to relationship (long-term) marketing has been proposed (Buttle, 1996). Across multiple studies, relational factors, such as, commitment and trust are consistently identified as focal constructs of relationship marketing (Morgan and Hunt, 1994). More broadly, researchers have coined the term 'relationship quality' to describe business relationships. Although definitions vary slightly across study contexts, relationship quality is typically assessed through some combination of commitment, satisfaction and trust (Dorsch *et al.*, 1998; Hewett *et al.*, 2002). Most of the research in the subject appears to follow the

assumption that intra-organisational relationships imply a closer collaboration than inter-organisational ones (Williamson, 1981; Lambert *et al*., 1996).

To achieve competitive edge and offer superior value propositions to their customers or suppliers, many businesses have launched a relatively long-term relationship. A shift in perspective from the individual transactions to the longer lasting relationships seems to be anticipated. This shift would mean that both the scope and time perspective of marketing would change from narrow and short to the vast and long. Consequently, it is a shift from short-term transactions towards more relational and social paradigm, which becomes the real focus in this study. Therefore, it would be interesting and valuable to discover and understand the role of social and relational attributes when firms adopt a newer form of Internet/web-based EDI - a quest for generating and enhancing customer value and sustained market competitiveness has led corporations to embrace a marketing strategy.

1.2 Problem Definition and Key Questions

Previously in the school of management, there has been a growing body of study focus on the buyer-seller relationships in business markets from an academic perspective as researchers have developed conceptual frameworks and integrated models of business-to-business interactions (Wilson, 1995; Wu and Choi, 2005) through insights into the nature and mechanisms of buyer-supplier relationships. A wide variety of relationship-relevant characteristics (Hewett *et al*., 2002) had been investigated. This study addresses an under-researched area of business-to-business relationships within the supply chain where there is not only relational but also social impact within parties having impact to the adoption decisions in web-based EDI.

Despite there has been theories in EDI adoption have discussed in general terms, the social and relational attributes were not yet adequately applied in the context of the newer form of EDI adoption via Internet – Web-based EDI adoption. For instance, Huang *et al*. (2008) previously found that some EDI-significant factors are no longer significantly associated with the web-based EDI adoption factors in their study of web-EDI Adoption.

Hence, this suggests that not all inter-organisational factors are significantly related to the web-based EDI adoption decision. In addition, compared to the vast existing literature on EDI adoption, relatively few works have studied business-to-business EDI adoption from a social or relational exchange perspective. Most related studies are conducted simply from the transaction-cost viewpoint, which may not fully explain the cooperative network nature of the business-to-business EDI adoption.

Different from previous traditional technological innovation, web-based EDI represents a new innovative approach to incorporate core business process (Teo *et al*., 2006; Lin and Lin, 2008). It is hence become problematic that such researchers are unable to clarify the relationship between business-level social attitude and relational behaviour on web-based EDI technology adoption. Moreover, in contrast to the considerable amount of inter-organisational system research in the area of EDI systems, there is very little empirical research on web-based EDI system adoption (Lee and Lim, 2005). This implies the underlying technology adoption of web-based EDI at the firm level has not been discussed or understood in sufficient detail.

Given that the adoption of Web-based EDI is a continuing adoption process of establishing electronic links and executing electronic transactions along value-chain activities, the social and relational aspects of inter-organisational system adoption have been recognised as a critical factor for EDI adoption. Moreover, since the web-based EDI lowers the asset-specific investment, and leads to new forms of relational exchange (Jap, 1999), the new technology allows for a more rapid adoption and a more relational type of exchanges mechanisms. Therefore, in line with other research, it is believed that social and relational factors should be taken into account to explain the influence of IOS on inter-organisational relationships (Grover *et al*., 2002; Subramani and Venkatraman, 2003; Christiaanse, 2004). However, there are only limited effort to empirically validate the social and relational relationships in web-based EDI adoption may leads to system failure, troubled relationships or other undesirable effects.

Although previous research on traditional EDI adoption is abundant, the revolution and new features of web-based EDI technology have made these studies outdated since

factors found by previous studies may no longer reflect current reality (Huang *et al*., 2008). Furthermore, there are very limited empirical investigation has focused on examining how the inter-organisational relational attributes have an impact on the adoption decision linked to web-based EDI systems based on open standards. In addition, research seldom links issues of social and relational aspects through social exchange theory at business level, while only a few studies examined EDI adoption in the transportation related industry (Johnson et al., 1992; Premkumar *et al.*, 1997) but not in web-based EDI adoption.

Being the trend of the future for businesses to adopt, web-based EDI offers many cost-effective benefits in exchanging standardised information with flexible connectivity to business partners, which leads to significant reduction to the switching costs of supplier and customers (Porter, 2001) and the cost in running daily operations. This makes it important to examine and extend our knowledge in the context of web-based EDI adoption. Given the increased usage of web-based EDI systems, it become very important to identify and quantify the influence of each construct in the adoption of web-based EDI. Therefore, this study has the following five key research questions:

1. What are the key antecedents that affect the adoption activities of web-based EDI?

2. What are the key social and relational factors attributed to the adoption of web-based EDI systems in the container liner shipping industry sector?

3. To what extent do those social and relational factors affect the web-based EDI adoption at business level?

4. What are the implications of these findings for the literature on web-based EDI adoption, both generically and specifically in the container liner shipping industry today?

1.3 Research Aims and Objectives

As firms seek to improve coordination through the use of information system technology, an open standard web-based electronic data interchange (WEDI) is becoming increasingly important for organisations to do businesses across geographic boarders. To adopt collaborative strategies and to maintain its competitiveness in a business environment that is getting more complex, unpredictable, and fast changing, firms must consider not only barriers at organisations and industry level, but also the motivation of powerful trading partners. To improve the current understanding of social and relational aspects of web-based EDI adoption factors, this study focus on the organisational adoption stage and examine how business-level social and relational factors influence the web-based EDI adoption in the context of container liner shipping industry.

The present study therefore attempts to expand our body of knowledge in this research stream by uncovering the different ways liner shipping companies can use web-based EDI to support their inter-organisational processes with their key suppliers and identifying the factors that will influence this use. To reach this objective, a set of nine independent variables to assess how global container liner shipping companies use web-based EDI to support their inter-organisational processes with key suppliers and identify two categories of determinants, namely those tied to the social characteristics of the organisation and those tied to the relational characteristics of its supply chain relationships, that should influence this use.

We then collect data to test the proposed dimensions of web-based EDI use and measure the influence of the determinants on each of those dimensions of use. By proposing an approach to web-based EDI measurement, this research contributes to increase the body of knowledge in the field of web-based EDI. This contribution should also expose practitioners and researchers to the different ways web-based EDI can be used by container shipping liner companies to support their relationship with suppliers as well as provide them with a better understanding as to the context that will promote this use.

Therefore, the aim of this research is to identify and explore inter-organisational collaboration of web-based EDI's adoption factors in the container liner shipping industry setting to understand, in particular, how the business-level social and relational factors influence the WEDI adoption in the context of container liner shipping industry. Based on the theoretical foundation around EDI adoption and three key inter-organisational system adoption empirical research (Lee and Lim, 2005; Boonstra and de Vries, 2005; Zhu *et al*., 2006), an integrated research model is then established showing the relationships of the key constructs.

Through numerous EDI literatures and the conceptual model, nine independent constructs are trading partner power, trading partner dependence, social network effect, perceived interests, trading partner trust, top management commitment, guanxi, technology trust and trading partner e-Readiness. To explore how the business-level social and relational factors influence the WEDI adoption in the context of container liner shipping industry, the present thesis poses several research questions listed in section 1.2 and three objectives as follows:

First, is to determine the key constructs that is relevant to the adoption to web-based EDI.

Second, is to systematically examine which existing theories may best used in the study.

Third, is to examine the relationships of the nine constructs within the proposed research model of web-based EDI adoption.

1.4 Importance of Study

Organisations now significantly allocate portions of their budget each year to obtain new information system and technology, and this trend has become more obvious following the advance of information system and technology and the development of web-based information system technology. Therefore, understanding factors that influence business-level innovative technology adoption is just as important as understanding individual-level new technology adoption in business supply chain.

In the context of traditional EDI adoption, a recent study has suggested that some EDI-significant factors are no longer significant for web-based EDI, and not all inter-organisational factors are significantly related to the adoption decision (Huang et al., 2008). What's more, in the study of Shang, Chen and Liu (2005), it was concluded "... despite it appears to have conclusive evidence showing the existence of same relationship between web-based EDI adoption and the three factors, it indicates that some other factors might be more important than the existing factors in influencing the decision to adopt web-based EDI." Therefore, although it might be imperative to assess the perfect applicability of traditional EDI literatures, attempting to understand new adoption factors from different perspective that influence the new business-level innovative technology adoption in web-based EDI would contribute more understanding in inter-organisational system adoption literature.

Current studies attempting to find the determinants influencing individual-level information system and technology adoption are heavily based on behavioural theories, such as technology acceptance model (TAM) and innovation diffusion theory (IDT) (Hernandez *et al*., 2008). Literature on business-level technology adoption is scare compared to general literature on examining individual level technology adoption and in particular contains few studies adopting the social exchange theory (SET) standpoint. Since there is only limited effort to empirically validate the social and relational relationships on business-level technology adoption literature. It is important to note that this study focuses on the organisational adoption decision, a group decision process, where many other organisational factors may also play a role in the adoption decision. It

draws upon the literature on social exchange theory to understand how the multi-dimensional constructs of inter-organisational relationship attributes would influence the adoption of the technologies of web-based EDI systems.

Moreover, owing to the networking nature of the technology, the more organisations that adopt, the higher the benefits are to all adopters. Therefore, recognising the factors that influence web-based EDI adoption will be useful in suggesting strategies to overcome the constraints that inhibit adoption. This line of inquiry benefits both researchers and practitioners. Researchers will benefit from the study's theoretical insights and explore further Web-based EDI adoption and diffusion patterns. Practitioners who learn why organisations adopt EDI and what the related factors are that influence the adoption process will make better strategic decisions concerning the adoption of web-based EDI.

1.5 Thesis Structure

To identify and explore inter-organisational collaboration of web-based EDI's adoption factors in the container liner shipping industry setting and to understand, in particular, how the business-level social and relational factors influence the WEDI adoption in the context of container liner shipping industry, this thesis is structured into the following seven chapters.

Chapter One briefly outline the business challenges in managing the supply chain relationship and the importance of the cooperative relationship through business's adoption to EDI. With the advance in Internet and Web technology, In order maintain the competitive edge in managing today's complex network relationships a more web-based/Internet EDI enables the integration of information flow between suppliers and customers. Hence, the need for a much closer business relationship to manage the extended enterprise (through web-based EDI adoption) became important. By defining the research problems, consequently, formulating the key questions, this introduction chapter also presents the aims and objectives of the research as well as its importance.

Chapter Two introduces the importance and the collaborative role of traditional EDI and web-based EDI adoption to today's supply chain management in details. Addressing the underlying principles of EDI adoption literature in the past, the current use of web-based EDI in the container liner shipping industry, and the nature of the shipping industry associated with the use of web-based EDI. Finally, outlines the challenges and new paradigms that move from transaction-type towards relational and social-type of supply chain relationships nowadays.

Chapter Three construct the theoretical background of the study in the area of EDI adoption. It offers a deeper review of the conceptual base with an addition of three key empirical studies. Then discusses in more detail on the nine independent constructs: trading partner power, trading partner dependence, social network effect, perceived interests, trading partner trust, top management commitment, guanxi, technology trust and trading partner e-Readiness by comparing and contrasting the social and relational

exchange theory with other major approaches in inter-organisational adoption and justifying why social and relational aspects are the key to focus adopting web-based EDI. Finally, it summaries the theoretical foundation into a single, coherent conceptual framework by synthesising the fundamental theories with the research in the field of EDI adoption and a set of hypotheses are derived.

Chapter Four begins with a discussion on research philosophies regarding to different paradigms and matter of ontology and epistemology. Outline the chosen methodological approach for data collection, starting from the process of developing and administrating of the questionnaire to the methods employed during the analysis of data and explains approaches of gathering valid and reliable samples in measuring those key constructs. It also shows the items of each constructs were modified and refined based on the result and the implication derived from the Case Study 1. Finally, shows areas of non-response bias control as well as ethical consideration of the research.

Chapter Five presents the collected data by giving a review of demographic structure of the respondents from Case Study 2 and Case Study 3. Reliability, validity, and correlations of the constructs were shown and discussed. PLS Structural Equation Modelling is used to test the hypotheses. Measurement validation is also addressed to establish its reliability and validity.

Chapter Six presents the quantitative findings of the analyses with interpretations that can be extracted from the results. Based on the proposed research model, four categorical aspects have been discussed separately, namely *Social Resources*, *Relational Resources*, *Perceived Interests* and *Technological State*.

Chapter Seven begins with an overview of the research and today's container liner shipping Industry, states how the main aims and objectives were achieved. State how the proposed research model and the case studies answered the research questions. It also covers the main contributions to both academia and industry. It concludes with the limitations of the study and the prospects for future research.

Chapter 2

Literature Review:

The Use of Web-based EDI in Today's Collaborative Supply Chain of the Container Liner Shipping

2.1 Importance of IOS Adoption in Today's Supply Chain Management

Today, business organisations across the world are under increasing pressure than ever to stay responsive and dynamic in all their competitive frontiers, especially under the effects of recent global recession. Many companies have begun to realise the need for moving towards collaborative supply chain management through information technology innovation and adoption that can effectively combine their core competencies with the capabilities of its suppliers.

Inter-organisational system (IOS) adoption, consequently, becomes vital for any organisation that wants to take advantage on its core competencies to gain and retain competitiveness. By providing more up-to-date information and allows for more accurate inventory responses to demand changes and thus more appropriate inventory levels throughout the supply chain (Levary, 2000; Stank *et al.*, 1999), better information exchange among supply chain partners certainly is the key advantage of the supply chain management (Lee *et al.*, 1997; Levary, 2000). With implementation of supply chain management via Inter-organisational technology adoption, the narrow focus of managers and the adversarial relationships between logistics providers, suppliers, and customers are replaced with strategic alliances and long-term cooperative relationships (Tan *et al.*, 1998) with the objective of "maximising competitiveness and profitability for the company as well as the whole supply chain network including the end-customer'' (Lambert *et al.*, 1998, p. 4).

Supply chain management has been defined by The Global Supply Chain Forum as ''. . . the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other

stakeholders'' (Lambert e*t al.,* 1998, p. 1). Supply chain management is also viewed as a proactive approach to manage the total flow of a distribution channel to the ultimate customer (Matthyssens and Van den Bulte, 1994) by the increased customer-service reliability, reduced inventory (Boddy *et al.*, 2000) so as to lower the uncertainty and transaction costs (Bechtel and Jayaram, 1997). Therefore, this dynamic and customer-driven concept (Melnyk *et al.*, 2007), has been constantly evolving and changing in response to strategic changes in the firm, technology, competitive response, with faster changing demands from suppliers and customers that ultimately enhances the ability of a firm to develop and maintain greater competitive advantages.

The key is that it is through the adoption and the integration of information system technology, operations, logistic, procurement, and marketing within the upstream portion of a firm's supply chain, many companies are able to improve service quality, responsiveness and delivery performance while simultaneously reducing cost. What is important is that it is through the adoption of inter-organisational system to effectively exchange business information within the supply chain in today's supply chain management. As managers searching ways to improve efficiency and efficacy of business activities, there are mainly three broad options emerge: through initiatives, such as, re-engineering to optimise activities locally; leverage scale and expertise of an external vendor; and relocate activities to take advantages of geographic advantages (Sharma and Loh, 2009). However, none of these benefits could be delivered without collaborative relationships within the supply chain. Because the successful supply chain requires close collaborative relationship.

A closer relationship with key suppliers can be realised at operational level, for instance, in the form of delivery services or improved quality, reduced cost, or some other combination; at a strategic level, making sustainable improvements in product quality and innovation, enhanced greater competitiveness, and increased market share, then ultimately lead to improvements in financial performance. Because of more time spent interfacing with fewer suppliers and buyers (the elimination of multiple sourcing through global strategic sourcing), the inter-organisational partnerships can then be focused on the whole supply chain rather than diluting each firm's effort through conflicting goals.

2.2 Collaborative Role of IOS Adoption

The concept of collaborative relationship in the supply chain does not appear to be easily defined. Simatupang and Sridharan (2003) define it as "two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation". Moreover, Mentzer *et al.* (2000), seeking to define supply chain collaboration based on the views of practitioners defined it as "all companies in the supply chain actively working together as one toward common objectives". Bahinipati *et al.* (2009) take a broader view and define it as "a business agreement between two or more companies at the same level in the supply chain or network in order to allow greater ease of work and cooperation towards achieving a common objective". Similarly, Kahn and Mentzer (1996) also defined internal collaboration as "an effective process, where departments work together willingly".

In line with Humphries and Wilding (2004), I would like to argue collaborative supply chain as working jointly to bring resources into a required relationship to achieve effective operations in harmony with the strategies and objectives of the parties involved, thus resulting in mutual benefit (Humphries and Wilding, 2004). It focuses more on the importance of supply chain relationships, which brings cooperation towards achieving a common objective and mutual benefits. Since inter-organisational system adoption (such as, EDI) supports the organisational boundary spinning activities, this 'extended organisational boundary' can effectively and eventually turns those partners into the today's collaborative supply chain.

Traditionally, transaction-oriented relationships between organisations have led companies within supply chains to act as competitors trying to take advantage of each other to maximise one's own utility. As a result, companies see themselves as buyers of goods and sellers of value-added goods. This adversarial business model, consequently, promotes opportunistic behaviours as the profit made by others is seen as an opportunity to improve one's own benefits (Karuranga *et al.*, 2008).

The number of publications on subjects such as, partnerships, coordination, alliances,

integration, and collaboration in the supply chain has been growing since the 1990s. A number of studies have been promoting the benefits of collaborative approaches (Mentzer *et al.*, 2000; Wagner *et al*., 2002). Some of the claimed benefits include, reduced cycle times lower cost and inventory, higher efficiency, faster time to market, higher profit margins, improved customer service, increased risk sharing, improved learning and learning and knowledge exchange, improved shareholder value and increased competitive advantage over other supply chains (Holweg *et al*., 2005).

Many authors have provided empirical evidence of these claims supporting the view that collaborative supply chain can improve customer services, reduce waste and generate mutual benefits by sharing risks and rewards (Fearne *et al.*, 2006). However, over the years, it appears to have emerged that through a combination of the two integrating firms as the most dominant approach, making collaboration an essential element to integration (Skjoett–Larsen *et al*., 2003).

Collaborative supply chain has also been associated with improved performance, for example, Frohlich and Westbrook (2001) have shown that collaborative relationship strongly associated with performance improvement. In addition, Kahn and Mentzer (1996) argue that collaborative supply chain can improve inventory management, forecast accuracy, customer service, increasing customer and employee satisfaction. Furthermore, Gimenez and Ventura (2005) indicates that internal and external collaboration influences each other as it is argued that internal collaboration has a positive effect on external collaboration because better coordination among internal functions facilities coordination with external companies. Similarly, external collaboration promotes internal collaboration by emphasising the benefits of working together.

However, substantial cooperation via inter-organisational system adoption might have a positive impact in attitude away from the adversarial attitude of conflict to one of mutual support and cooperation. Hence, it is not possible to have a fully relational supply chain without a collaborative relationship that provides a great opportunity to focus on customer end value rather than transaction costs.

2.3 Inter-organisational Relationships: The Key in Managing Today's Supply Chain

Supply chain partners frequently work collaboratively to meet the diverse demands of their serving market. For instance, areas such as contact, interaction; join programs and written agreements between trading partners having equal aims to the product or service delivery, quality, productivity and consumer satisfaction. Thus, collaborative supply chain relationship refers to concentrating bilateral efforts on achieving goals that would not be easily attainable alone (Tucker, 2008; Bajgoric and Moon, 2009).

Several authors have been examining the role of inter-organisational relationships in business in general, especially in the buyer-seller context. Though theoretical frameworks such a transaction cost economics (Williamson, 1985) and the resource based view of the firm (Wernefelt, 1984), they have been used to explain firms' motive to collaborate, and the impact it has on their relationship development.

Despite benefits for the participants achieved by cooperative supply chain relationships has also been widely accepted (Christopher, 2005), it is also recognised that full supply chain management implementation is not being achieved (Kempainen and Vepsalsinrn, 2003) partly due to trading partners' common short-terms view, and frequently during the increasing complexity and uncertainty in the marketplace, which limits the extent to which supply chain partners extend their collaborative focus (Fawcett and Magnan, 2002).

This can cause negative impacts to the supply chain, such as power abuse, lack of transparency, poor communications and reluctance to adapt attitudinal change (Anscombe and Kearney, 1994). From the view of the supply chain integration, it indicates the need for closer relationship that includes trust, commitment and collaboration to ensure success in these arrangements (Spekman *et al*., 1998). In addition, Perks and Easton (2000) point out that supply chain management provides a business environment where firms closely cooperate, instead of competing to achieve mutual goals. However, Macbeth and Fergusson (1994) consider that managing supply chain players is wasteful of resources and drags performance backwards rather than promoting continuous

improvement. In addition, it is criticised by Cooper et al. (1997) that it is too difficult to manage and achieve true supply chain integration because there are too many considerable complicated management problems need to be solved before it all work. In particular, it is also very expensive in management effort to maintain close relationship. Besides, despite cooperation and coordination are important successes factors, a fully relational supply chain cannot be achieved without collaboration. Therefore, collaborative relationships play a key role throughout the supply chain in achieving benefits for all participants. This actually involves closer relationships between members that include trust, commitment and collaboration (Spekman *et al.,* 1998).

Although suppliers recognise the need to integrate with their partners, it is apparent that full supply chain management implementation is not being achieved for some other reasons (Spekman *et al.*, 1998). It appears that importance of long-term partnering relationships particularly on complex problem solving is the key to the supply chain management (Boddy *et al.*, 2000). Previously, it was also recognised the need to base them on openness, shared risks and rewards that leverage the skills of each partner to achieve competitive performance that cannot not achieved simply by the individual (Lambert et al., 1996). However, it is argued that firms are still taking a short-term view that eventually leads to adversarial relationships (Braithwaite, 1998). Consequently, the development of partnering relationships can be obstructed by poor communications or some kind of attitudinal change (Anscombe and Kearney, 1994).

Similarly, in the study of EDI adoption in Portugal's clothing and textile industry stated that due to the cooperative role of EDI, managers' attitudes towards collaboration will have an influence whether EDI will be adopted by the companies (Dhillon and Caldeira, 2000). As trading partners have the same intention to improve areas of the mutual concerns, most of these collaboration can only be attained through the use of internet enabled inter-organisational system technologies (Riggins and Rhee, 1998). This claim has been supported by Subramani's (2004) research which found that the use of IT is a significant determinant leading to closer buyer-supplier relationships. Thus if organisations are more willingly to collaborate with their trading partners, they are more likely to adopt inter-organisational system in their supply chain to improve the

collaboration process. Therefore, it is important to achieve good business-to-business relationships through partnering in order to achieve the operational benefits of the supply chain via the adoption of EDI.

In short, as today's supply chain partners now involve closer relationships between members, such as trust, commitment and collaboration, it appears inter-organisational relationship play a vital role in the adoption of inter-organisational system, which then has a great impact on the collaboration process of the modern supply chain. Despite previous studies suggested that firms are still taking a short-term view that eventually leads to adversarial relationships, the supply chain implementation has not yet achieved fully. Hence, there is a need to focus on the inter-organisational relationships that influences the adoption of EDI and web-based EDI.

2.4 Traditional EDI vs. Web-based EDI

The uses of traditional EDI remains in the early adoption stage despite more than 30 years of development. Well-known retailers, such as Wal-Mart would operate very differently without the EDI because it is an integral and essential element of their business strategies. Thousands of global manufacturers, including Toyota, Unilever and Procter and Gamble, have used EDI to redefine relationships with their suppliers and customers that changed the business landscape, and triggered new definitions of the industries. However, the adoption of web-based or internet-based EDI in the modern organisations signals a major paradigm shift that changes the ground rules by which business competes in markets and interacts with their suppliers or customers as web-based EDI appears to stand a better chance of achieving a greater competitive advantage more than that of the traditional one.

2.4.1 Definition, Role and Characteristics of Traditional EDI

Electronic Data Interchange (EDI) is the transfer of data in an agreed upon electronic format from one organisation's computer program to one or more organisations programmes (Li and Lin, 2006), which involves standardised inter-organisational communication between independent information systems and technological components that enable this.

Emerging in the late 1960s when transportation companies were looking for ways to reduce large volumes of paper documentation, the use of traditional EDI became popular and widespread in the late 1980s via Value Added Networks (VAN). This was a prominent development in electronically connecting companies (Power and Carver, 1990). For instance, Chwelos *et al.* (2001) argue that as business-to-business e-commerce gains prominence, the use of EDI will remain an important enabling technology. Similarly, Premkumar *et al.* (1994) conducted a study of EDI adoption by companies and they identified benefits such as reduced costs, faster turnaround, and better customer services and to a certain extent strategic advantage over their competitors.

The main driving factors for EDI include streamlining standardised routine business processes, and back office integration of information systems thus achieving efficiencies from direct savings (i.e. administrative costs and transaction costs). Indeed, several researchers have found that EDI has played a central role in enabling the integration of business processes from the end-users through organisational suppliers that produces products, services, and information that add value to the end customers (Premkumar *et al.*, 1997; Grover *et al.*, 2003).

EDI, unlike other types of information technology innovations, cannot be adopted and used unilaterally; organisations motivated to adopt EDI must either find similarly motivated trading partners or persuade their existing trading partners to adopt EDI (Hart and Saunders, 1998; Webster, 1995). Both companies in an EDI relationship have to use interoperable hardware and software platforms. Thus, EDI requires integration with other applications for tasks such as; materials planning, payment, accounts payable to create real benefits. Therefore, standards play an important role in EDI adoption as they contribute to uniform business practices, trade messages, such as purchase orders, purchase order acknowledgement, and invoices (Christiaanse and Markus, 2002). Standardisation enforces a routine structure for transaction exchanges that in turn leads to integration and interoperability of the IT systems. If messages were not standardised, then the company receiving the message might be unable to process the message that was sent by another company. Standardisation, therefore, facilitates EDI exchanges

(Mukhopadhyay *et al.*, 1995).

Since the mid-1980s, when the United Nations announced their commitment to EDI, vast resources and much symbolic power have been poured into developing common standards EDI. During the 1990s, two alternative EDI standards emerged: (1) ANSI X.12 for the American continent and Japan, and (2) the UN-supported EDIFACT (EDI for Administration, Commerce and Transport) standard for the rest of the world. In addition, a myriad of local implementation guidelines (and subsets) of these standards exist. This resulted in a slowdown of the adoption process, as companies were struggling to figure out which standard, subset, and version best fit their specific needs (Damsgaard and Truex, 2000). In most cases, these competing and overlapping alternatives did not lead to an increased adoption of EDI since not all the firms were able to meet the required close coordination and mutual adjustment in the proprietary systems of EDI.

By EDI adoption, we mean the uptake of the capacity to produce and use EDI in business practice by a set of trading partners, these interacting organisations are organised into a value chain that is located in an institutional context - the industry sector. This form of tightly coupled trading partnership that explicitly leverages capabilities of information technologies (IT) is variously referred to as electronic integration (Venkatraman and Zaheer, 1990), or electronic partnership (Hart and Saunders, 1998). This electronic business-to-business linkage among firms and suppliers via traditional EDI has been continuously cited as a crucial resource for modern standardised communication between firms (Kaefer and Bendoly, 2004). Overall, EDI has the following characteristics (Damsgaard and Lyytinen, 2001, p196):

- EDI is inter-organisational in that its use is not controlled by any centralised authority.
- EDI links organisations by electronic means so that the organisational boundary is lowered and organisation's interior is exposed to business partners (Webster, 1995)
- EDI relies on the telecommunication infrastructure, Value Added Networks

(Kimberley, 1994)

- EDI forms a complex innovation in that it requires considerable skills and know-how to implement and operate (Webster, 1995). It also exhibits path dependencies in that adopting organisations must link their internal information systems to EDI service to reap its full benefits.
- Standards are essential in EDI adoption so that creates a high degree of organisational interdependence between participating organisations (Horluck, 1994) and necessitates some degree of institutional regulation (Swatman and Clarke, 1990).
- In decisions to adopt EDI, network externalities are important. In addition, EDI assumes a critical mass to be efficiently deployed.

Overall, EDI has been significantly changing the way business is conducted and these changes having a great impact on most industries. For instance, there is a substantial amount of information flow occurs across various organisational entities (suppliers, customers, banks, and transportation carriers) for the completion of a business transaction in the supply chain. The conventional information communication activity used to be a labour intensive process (including paper, face-to-face, telephone, or fax); a switch to electronic communication would significantly improve the efficiency of the operation, which is in an automated and structured form of transaction communication between trading partners (McGee, 1987).

In the transportation industry, EDI can help to provide electronic bills of lading, purchase orders, delivery tracking, freight billing, electronic funds transfer, etc., which is essential to the movement of shipments, resulting in reduced paper processing and immediate access to information. While the firms are increasingly feeling the competitive pressure to use EDI in order to maintain the demand from the existing customers, EDI is expected to result in improvement in operational efficiency, quick response, greater accuracy, and lower operational costs (Johnson *et al*., 1992).

However, there have been several reports of disadvantages. First, the additional costs associated with the Value Added Network services become a cost-barrier for small

companies wanting to adopt an EDI environment to communicate with business partners. Second, to avoid difficulties, establishing EDI between trading partners requires compatible hardware at both ends in order to have seamless processing. Third, is about the requirement of the pre-agreed standards and protocols. Several common industry-specific standards are required to establish EDI: the Transportation Data Coordination Committee (TDCC) used in the transportation industry, Uniform Communication Standards (UCS) used in the grocery industry, and ANSI X.12 developed by the American National Standard Institute. Given the different standards, a company that is a member of multiple supply chains in different industries would have to deal with multiple standards of communication, resulting in costly operations and system redundancies. Finally, because of the significant initial and operational investments, both the customer and the supplier are typically contractually tied to a long-term relationship. Although this may be beneficial, it has some drawbacks. Over time, other suppliers may come up with higher quality, lower priced, or better services and products. In such cases, switching costs associated with establishing a new linkage may prevent companies from making changes otherwise.

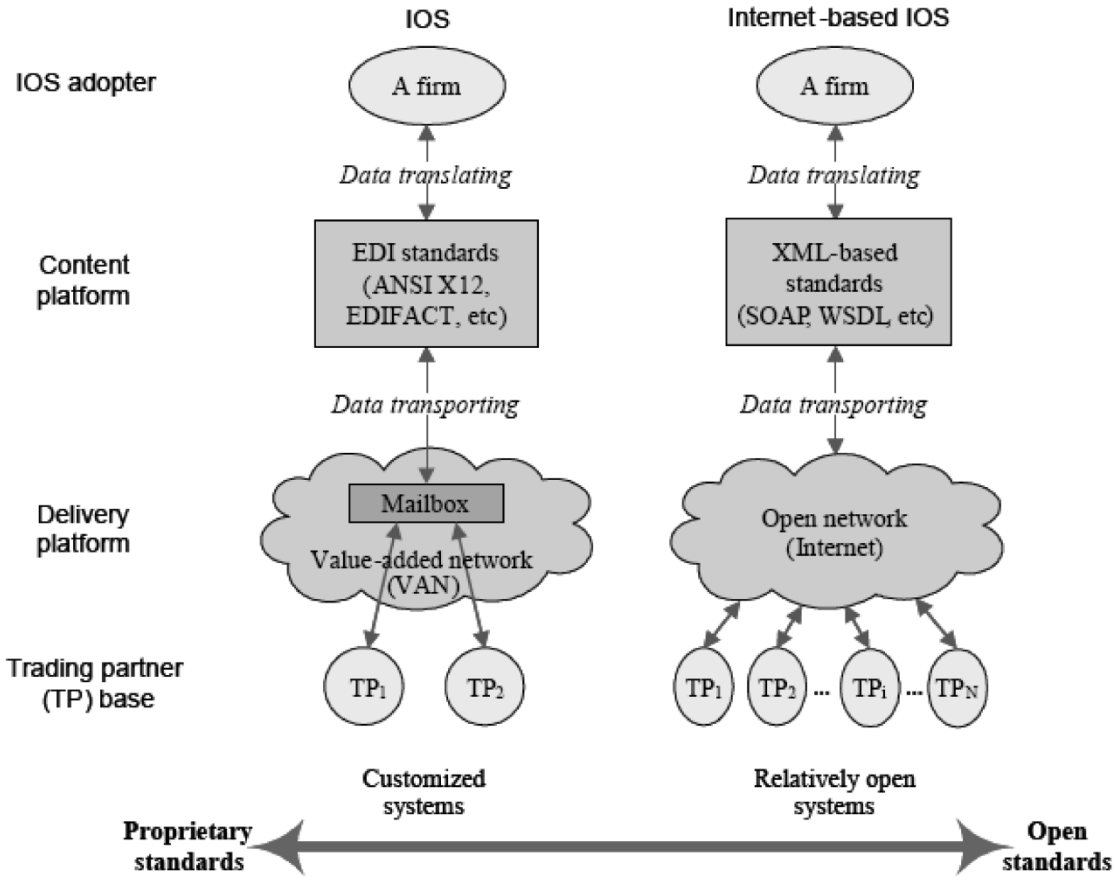
Since the traditional EDI has its disadvantages that usually associate with the costs, consequently, it had fairly limited impact in transforming the electronic inter-organisational relationships. The reported disadvantages of EDI have resulted in the idea of exploring the Internet as a viable alternative to establishing a web-based EDI, which has less cost-related issues, involving further inter-organisational relationships between the supply chain trading partners across different organisational boundaries in different parts of the world.

2.4.2 Definition, Role and Characteristics of Web-based EDI

The introduction of internet and web services has been changing electronic connections between firms. A major distinction between traditional EDI and web-based EDI is their delivery platform and communication protocols: private VAN vs. Internet VAN (Zhu *et al*., 2006). Figure 2.1 illustrates the communication platforms of traditional Inter-organisational Systems (IOS) and Internet-based IOS. The cost of internet

communication is significantly lower than that of private VAN (Cai *et al*., 2006). Internet provides a low-cost alternative to private VAN for data exchange. Increasingly, companies have or plan to adopt Internet-based IOS. Therefore, IOS research is being migrated from traditional EDI to web-based EDI (Zue *et al*., 2006).

Figure 2.1: Comparison of IOS and Internet-based IOS



Source: Zhu *et al*., 2006

Grossman (2004) defined Internet-based IOS as Internet-based information systems shared by two or more organisations, such as web-based EDI, supporting the automation of manual processes. It has been reported that web-based EDI participants are not only buyers and sellers, but also include affinity organisations or competitors. Compared with the traditional EDI, Web-based EDI enhance a range of new features for information sharing, communication, and collaboration (Icasati-Johanson and Fleck, 2003). Due to the open nature of the Internet, the web-based EDI have natural differences in the number of communication protocols, cost, reliability and security. Web-based EDI generally improves the agility of the supply chain with greater competitiveness for the

organisations. It is seen as an viable alternative to deploy EDI via open systems architectures and standards, like the Internet's Transmission Control Protocol/ Internet Protocol (TCP/IP), providing a set of reliable, accurate and low-cost techniques, tools and services, which allow an organisation to conduct business with its partners via the Internet (Lehmann, 2002). Although the conventional EDI is also a reliable inter-organisational communication standard, value added network services are costly to setup, maintain and use.

With the growing familiarity and practicality of the Internet, web-based EDI became a strong alternative to establish Business-to-Business (B2B) communications that has appealed to many businesses as an efficient way to link trading partners along the supply chain. Although end-users might not experience significant differences between EDI and web-based EDI in terms of interface and transparency of technology, the true impact of the web-based EDI can be felt at the organisational level. Part of the reason is because web-based EDI can integrate dedicated and non-dedicated information systems, and therefore, reserve a higher flexibility and scalability in a cost effective manner. With millions of transactions daily, web-based EDI offers advantages based on the characteristics of the Internet, provides great efficiency for performing business-to-business transactions at much more affordable costs, while differentiating itself from the traditional EDI. Company like, FedEX use COSMOS, a web-based EDI information system, to manage inventory at rest as well as in transport (Farhoomand *et al.*, 2003). Below shows the major benefits of adopting web-based EDI.

1. Open standard. Internet has one communication standard of TCP/IP, regardless of the industry as opposed to one of the main obstacles, of EDI, which depends on industry-specific communication standards. The platform of internet affords enterprises the flexibility of customising some process-related parameters to adapt to the requirement of their partners. The deployment and use of such standards enable enterprises to simultaneously exchange information with multiple extended enterprise partners.

2. Cost saving. In addition to the reduction in expenses, initial investment and

operating expenses for web-based EDI, it also represents tremendous savings to organisations when compared to the traditional EDI.

3. Connectivity and expansion. The size of organisations plays an interesting role in putting more weight on the tendency to adopt web-based EDI since the high costs of establishing EDI with trading partners have prevented many small organisations from implementing electronic linkages with their partners, and has limited them from expanding their operations to include new alliances.

4. Scalability. It is another factor that differentiated itself that able to better accommodates growth demand than EDI due to low demand for additional technical components, less training for employees and better chances of adding new trading partners (Soliman and Janz, 2003).

Compared with the traditional EDI, web-based EDI tends to increase as the number of system participants grows. Depending on the interaction patterns between the participants, web-based EDI can be configured in three ways: one-to-one, one-to-many, and many-to-many. With different system support levels (operational and strategic supports) different organisations may configure their Internet-based inter-organisational system in different linkages and different ways. At best, web-based EDI may involve all participating members coordinate their efforts and cooperate with each other (Lee *et al.*, 2005). New inter-organisational forms, such as outsourcing, partnerships, strategic alliances, and networked organisations are created between independent organisations in several industries (Ring and Van de Ven, 1994).

At operational support level, web-based EDI are primarily designed for supporting routine operations (Hong, 2002). Firms are connected to share their information as part of their day-to-day business to support a value or supply chain through the internet. For strategic support levels, web-based EDI is designed to provide resource-oriented cooperation that includes exploitation of the economies of scale in operations and transaction costs (Gurbaxani and Whang, 1991). In addition, web-based EDI may be classified into either electronic market or electronic hierarchy. Electronic market is designed to match buyers

and sellers who generally do not share a long-term relationship. Under electronic hierarchy, the organisations involved share a long-term relationship and align their internal processes with one another (Lewis, 2001). Web-based EDI change the structure of various industries and create competitive advantages and strategic necessity by giving companies new ways to cooperate with their supply chains.

In fact, despite the benefits from traditional EDI, in reality, the adoption of traditional EDI by transportation carriers has been rather slow (Premkumar *et al.*, 1997). This might because traditional EDI systems are proprietary and costly, smaller firms tend not to use them. On the other hand, previous research has suggested that both traditional EDI and web-based EDI share some common factors that influence the adoption decisions in the supply chain. Factors such as trading partner or competitor pressure derived from more powerful organisations within the supply chain, trust and inter-dependency between trading partners, the perceived benefits of the firms and the top management commitment have been reported to affect the EDI decision including that related to the adoption of web-based EDI adoption. In fact, since this web-based networked enterprise is the result of the collective and collaborative effort of various participants firms (Buhman *et al*., 2005) associated with increasing scale of information integration across organisational borders that supports real-time transaction over the Internet - an increased attention focusing on the importance of open standards (Zhu *et al.* 2006).

The advent of user-friendly web browsers in the early 1990s gave rise to internet-enabled EDI and business-to-business systems that are affordable, even for small firms. Therefore, as the trend of industry has promoted firms to further migrate towards the emerging network-centric type of enterprise that has the behaviour characteristics of a large complex interconnected network in which participating firms interact by a set of linked products, services and technologies (Rouse, 2005) to capture customers' real choices in real time over electronic network. With the adoption and diffusion of new technological standards nowadays, facilitated by the development of open standards, such as the Transmission /control Protocol/Internet Protocol (TCP/IP) and eXtensible Markup Language (XML), has enabled the Internet-based EDI system steadily become a popular platform for inter-firm coordination (Shapiro and Varian, 1999). As the Internet is

maturing rapidly and businesses are taking notice and recognising its power. More and more corporations are adopting Internet capabilities to their B2B e-commerce process along with existing traditional EDI functionality, extending trading communities increased functionality, and more comprehensive automation of the business cycle and lowering the financial barriers to e-commerce participation.

As a result of the efficiency cost savings that the Internet can bring, the arrival of new Internet-based applications and services has allowed such integration more readily by allowing larger networks to be established and greater flexibility in systems to be achieved. Therefore, the Internet has introduced a new set of possibilities for inter-business relationships and the potential for greater efficiency benefits along the supply chain. Overall, web-based EDI differs from traditional EDI in four major aspects.

- Communication Protocols

Traditional EDI is proprietary and was designed to support limited proprietary protocols at one time. A significant level of configuration and coordination to resolve the differences in backend systems is needed for the smooth communication of multiple parties. In contrast, web-based EDI works over the TCP/IP protocol. TCP/IP is a public standard opened for the use of everyone. Moreover, web-based EDI allows business partners to connect instantly, regardless of their differences in backend systems. Thus, a much lesser degree of configuration is needed for web-based EDI.

- Deployment Cost

The commonly argued reason for a company not adopting traditional EDI is its high deployment cost. The cost includes purchasing EDI software, customising EDI by developing conversion software, integrating EDI with the existing information systems, and establishing the data communications and networking infrastructure with business partners. The success of an EDI project depends on these variables. As a result, the deployment of an EDI is extremely complex and needs continuous support to maintain the EDI system and training for users (Wellington Consulting, 2002). Unlike a typical Value Added Network, web-based EDI adopts an open networking infrastructure. Hence, it has a higher flexibility and scalability than traditional EDI without adding additional cost.

- Efficiency and Reliability

Without a proper management in place, the open nature of the web-based EDI may encounter the following problems. Since we cannot predict traffic on the Internet, it is possible web-based EDI slows or terminates in the process of a transaction. The mechanism for IP security and networking management must be in place to monitor, detect, and correct these potential problems. In contrast, traditional EDI has a higher degree of reliability because users can demand Value Added Network to provide certain quality of service level. The network traffic is regulated and its growth is managed. As a result, users can have a guaranteed bandwidth and protection to access traditional EDI.

- Security

Web-based EDI is potentially less secure than traditional EDI because transactional activities are highly distributed among users. Confidential information may be intercepted between the sender and recipient. The packet switching technology may pose threats to the manageability of web-based EDI. We have little control of the traveling path. The emerging technology of multiple protocols layered systems (MPLS) and general routing encryption (GRE) support the creation of Virtual Private Lane (VPN) for Internet-based communication. As the technology becomes more mature, web-based EDI may gradually address the security issues. Table 2.1 summarises these major differences between web-based and traditional EDI.

Table 2.1: Traditional vs. web-based EDI

Constructs	Web-based EDI	Traditional EDI
Communication Protocols	■ A standardised protocol TCP/IP ■ Improve business agility ■ High flexibility and accessibility ■ Wide Area Network independent of VAN provider	■ Proprietary communication protocols ■ Rigidity ■ Limited to the coverage area of VAN providers
Cost	■ Lower deployment cost ■ Lower configuration expenses ■ Lower operational cost	■ Higher deployment cost ■ Higher configuration expenses ■ Higher operational cost
Efficiency	■ Access timely and historical data ■ Improve the inter-organisational cooperative relationship	■ Access data in batched mode ■ Improve operational efficiency
Security	■ Lower transaction security	■ Higher transaction security

2.5 Previous EDI Adoption Literature: The Underlying Principles

In fact, EDI has been studied intensively for several decades. Many studies investigate EDI adoption from technological, organisational, economic and socio-political perspectives. EDI studies from economic perspectives, e.g., Premkumar and Ramamurthy (1995), apply theories from microeconomics and transaction costs to investigate the formation of markets and formulation of various channel decisions, examining inter-organisational relationships based on efficiency considerations and the impact of EDI adoption on markets (Malone e*t al.*, 1987). From a socio-political perspective, however, researchers contend that a firm forms inter-organisational linkages primarily to gain control over critical resources and thereby reduce uncertainty in their acquisition. The technological adoption decision consequently became a reflection of their social and political anxiety and needs. While both research streams can more or less justify their viewpoints from their own perspectives, it appears that they overlook important issues on the other side.

Comprehensive frameworks are recommended to investigate EDI adoption (Chwelos *et al*., 2001). For example, in Chwelos et al.'s frameworks (2001), three major categories of factors are applied in the investigation: technological, organisational, and inter-organisational. The advantage of using a comprehensive framework is a structure to categories a large number of determining factors and the convenience to compare the effects of these factors. This literature review extends Chwelos frameworks by examining inter-organisational system adoption from four distinct perspectives.

A dominant portion of past EDI empirical literature had concentrated on traditional EDI adoption for years. By definition, because adoption of EDI requires co-ordination between at least two organisations, the inter-organisational relationships between the organisation and its prospective trading partners become the key area which attributed to the adoption of web-based EDI system. Recent EDI research has incorporated both inter-organisational and organisational factors. Saunders and Clark (1992) examined the impact of *perceived benefits* and *perceived costs* (both organisational factors), as well as *dependency* and *trust* (inter-organisational factors) on intent to adopt EDI. They found that increased perceived costs reduce intent to adopt, as does, somewhat surprisingly,

higher levels of trust. Bouchard (1993) found that Innovation Diffusion Theory factors were not significant in the EDI adoption decision, whereas the *use* or *requirement* of EDI by major business partners were the key drivers of the adoption decision. Premkumar and Ramamurthy (1995) found that the organisational factors *internal need* and *top management support,* as well as the inter-organisational factors *competitive pressure* and *exercised power,* influence whether a firm's EDI adoption decision is proactive or reactive. Iacovou, Benbasat, and Dexter (1995) hypothesise a model that includes three factors as determinants of EDI adoption and impact in small and medium-sized enterprises: *perceived benefits* (technological), *organizational readiness* (organisational), and *external pressure* (inter-organisational). However, this model has not been empirically tested outside the small sample of firms.

Premkumark, Ramamurthy, and Crum (1997) examined EDI adoption in European trucking industry, finding that *firm size* and *top management support* (organisational factors), as well as *competitive pressure* and *customer support* (inter-organisational), were significant in predicting adoption of EDI. Hart and Saunders (1997) have developed a theoretical framework, positing *relative power* and *trust* between trading partners as determinants of EDI adoption and usage, illustrated with the case study of an office supplies retailer. Hart and Saunders (1998) examine the impact of *customer power* and *supplier trust* on the use of EDI (transaction volume) and diversity of EDI (number of transaction sets) for the customers of two firms. Their overall empirical findings are mixed, showing that: (i) increased supplier trust leads to increased diversity of EDI use; and (ii), increased customer power leads to reduced diversity of EDI use.

The factors influencing the integration of EDI within adopter firms and the subsequent impact has been studied in the motor carrier industry (Ramamurthy, Premkumar, and Crum, 1999). Both organisational factors (*internal support, EDI's benefits potential, EDI-compatibility,* and *resource intensity*) and inter-organisational factors (*customer support* and *competitive pressure*) were shown to influence EDI integration. Crook and Kumar (1998) examined EDI use in four diverse industries, using a grounded theory approach to explain types of use in different contexts, strategies for encouraging EDI, and its consequences. They derived a model that includes factors that are part of perceived

benefits, external pressure and readiness as described in the Iacovou *et al.* (1995) model.

EDI has also been studied using the perspective of microeconomics, and some of this work has provided direct estimates of the financial impact of adopting EDI. More recently, Son *et al.* (1999) use transaction cost theory and social cost theory to identify several variables hypothesized to be associated with the extent of EDI use. These include *reciprocal investments, trust,* and *power.*

From a socio-political perspective, however, researchers have argued that a firm forms inter-organisational linkages primarily to gain control over critical resources and thereby reduce uncertainty (Huang *et al.*, 2008). For instance, Premkumar *et al.* (1997) examined the Inter-organisational and organisational factors that influence the decision mode for adoption of EDI. Hart and Saunders (1997) developed a theoretical framework to address the roles that power and trust play in EDI adoption.

Since the adoption of EDI is a joint decision between two (or more) trading partners, there are various forces influence the inter-organisational relationships between the two partners and thereby the adoption decision (Huang *et al.*, 2008). These variables have been drawn from different theoretical foundations in economics, strategy, marketing, organisational behaviour and information system, and have been used in different context. Researchers have also identified and categorised components affecting inter-firm exchange process in different ways. For instance, Zhu *et al.* (2002) use a technological, organisational, and environmental context to build up a framework for a cross-country study of e-business adoption context; those approaches are supported by research on inter-firm links of both formal and informal relationships. Some use relational and structure embeddedness in the research; other scholars use structural and social bonds (Wilson and Vlosky, 1998) or technical and social relationships (Perry *et al*., 2002).

To conclude, the topic of EDI adoption has been studied using a variety of approaches and constructs with different operationalisation. At this time, from a number of different studies, there are several partially overlapping, divergent models that have been shown to each explain a portion of the EDI adoption decision by examining different factors.

While each has contributed to our cumulative knowledge, and explained a part of the adoption decision, no single study has tested a model of that incorporates constructs that comprehensively address the relational, social, and inter-organisational levels.

2.6 The Use of web-based EDI in Container Liner Shipping Industry

2.6.1 Evolution of Container Services in Liner Shipping

Shipping is a service industry that facilitates the lifeline of international trade, and it is by its nature, global. Container shipping industry, a segment of the liner shipping industry, is a maritime industry, international if not global in scope. This industry operates vessels transporting containers with various but standardised dimensions/sizes, regardless of the contents. Whether filled or not, these container vessels are put in service in a regular basis and often according to a fixed sailing schedule, loading and discharging at specified ports while the market environment in which container shipping line companies are operating is substantially changing.

One of the major driving forces to change emerges from the globalisation process and the large-scale adoption of containers since the late 1960s. Facilitated through the elimination of trade barriers and the liberalisation and deregulation of markets, the rise of global containerisation is the result of the interplay of macroeconomic, microeconomic and some policy-oriented factors (Notteboom, 2004). Through public sector's privatisation and corporatisation schemes as well as market liberalisation, the development of global logistics has been enhanced in many ways. As a result of other factors such as global expansion into new markets, mass customisation in response to product and market segmentation, lean manufacturing practices and associated shifts in costs, customers' need for a wider array of global services and for more integrated service capability, these all make the global supply chains have become more complex and requires a serious attention.

The consequential intensified competition at the supply side creates pressures on the cost management and on margins. Overall, the shipping liners have been in a constantly

changing of a competitive environment. This might explain why the shipping liners have already started to cooperation between themselves via conferences (cartels) as early as 1875 when a few competing ship owners agreed on a uniform tariff and allocated sailings to each vessel.

In terms of profitability, prior the mid-1980s, container liners rarely had to worry about it in the first ten years of containerisation for two reasons. First, (through revenue pooling agreements based on a common freight tariffs) powerful liner *conferences* protected the freight rates on some particular shipping routes. Second, service patterns and capacity for specific trade routes was managed through *consortia* (including such as, joint operation of maritime transport services; temporary capacity adjustments; the joint operation or use of port terminals; a joint marketing structure or the issue of a joint bill of lading) at that time.

However, this old conference system has been progressively undermined by several factors: the introduction of containerisation and specialised container and vessels, the growth of the Pacific Asian economies; the development of independent shipping lines (mostly based in East Asia); and the demanding of shippers for a global service (Dick, 1996). Moreover, since nature of the container liners is to operate regular, reliable, and frequent service that involves high fixed costs, the combination of the capital-intensive operation and the high risks associated with the revenues makes the container carriers significantly underperform financially compared with other industries over the last two decades. Furthermore, economic forces (such as economies of scale) lead to surplus space onboard of the vessels that lines are eager to fill. Existing slot over capacity in some trades made freight rates collapse. Overall, liners have been in the situation that once the large and expensive networks are set up, the pressure is on to fill them with freight due to container shipping's cost-based nature. These factors explain the short-term instability in the industry (Brooks, 2000).

All liner shipping companies ('carriers' or 'container operators') are seem to being driven by similar fundamental forces: containerisation since late 1960s, globalisation of manufacturing and trade, technological innovations (especially those that support vertical

integration of transport services, e.g. electronic communications, automated data systems, larger/faster vessels, etc.) intense competition and low margins, development of global service networks, deregulation and privatisation and industry consolidation (Gregory, 2000). These forces have overall pushed almost all the liners in recent years, to seek extensive cooperation with others. This has prompted new closer cooperative agreements among the leading global container shipping liners since 1994, reflected mainly by formation of global strategic alliances. This formation of global alliances in container shipping has played an important role particularly in the recent history of container shipping sector.

This process of concentration (Thanopoulou *et al*., 1999; Notteboom, 2004) that has brought the industry from one-to-one international inter-firm collaboration to the era of multi-cooperation of global strategic alliances is particularly among those leading container carriers since 1990s (Midoro and Pitto, 2000). As a result, the establishment of the major three *global alliances* namely, *Grand Alliance* (Hapag-Lloyd, NYK Line, MISC, OOCL, CP Ships), *New World Alliance* (APL/NOL, Hyundai, Mitsui OSK Lines), as well as *CYKH Alliance* (COSCO, Yang Ming, and K-Line, Hanjin) has become one of the most significant developments in the industry over the last 15 years that dominates the world's busiest trade lanes (Leach, 2005).

Since carriers regard market mass as one of the most effective weapons in coping with a trade environment characterised by intense pricing pressure (Notteboom, 2004), cooperation through global strategic alliances should maximise the overall benefits when the combined costs of operations are lower than the cost of operating alone. Cooperation between carrier services is a means to access more loops (or services) with relative low cost implications, to share operational facilities (such as terminals, containers or ships), cooperation in areas at sea and shore, thereby achieving costs saving in the end of shipping operations (Slack *et al*., 2002).

However, due to the organisational complexity of the alliance and perceived intra-alliance competition that undermines trust between carriers involved, for example, strategic alliances itself have not become a stabilising factor in liner shipping (Midoro and Pitto,

2000). The lack of differentiation of partners' roles and the absence of coordination of marketing and sales still present the alliance structure from playing a key role in the alleviation of market instability (Notteboom, 2004)

In a container shipping industry already dominated by large vessels, and global strategic alliances, the potential cost saving still left are getting smaller and the pressure to find cost saving elsewhere is growing. Therefore, cooperative inter-organisational relationships via inter-organisational system, such as EDI or web-based EDI have become the key to be focused in how to cost-effectively managing the entire freight operation shipping process as well as generating profits through cooperation and sharing of resources.

2.6.2 The Freight Operation Process in the Container Liner Shipping

In order to understand how the role of web-based EDI fits in the container shipping industry, it is critical to firstly understand what the freight operation process in container shipping. Generally speaking, according to the National Research Council (2003), the freight operations can be categorised into the following tasks, each of which can be assisted or improved by the use of Information and Technology:

- *Matching a load with a carrier.* The cargo owner, or shipper, must identify and engage a carrier- truck, train, ship or a combination of modes. Freight broker, agents, and freight forwarders may be involved in this task. The technology involved can span the range from telephone and fax on the low end to Internet-based load bidding. If a multi-modal shipment is involved, the shipper or broker (agent) will either have to arrange each leg of the trip or request a carrier to arrange the entire intermodal movement.

- *Order acceptance.* It is necessary to establish a dated record of the carrier to which the load is assigned. This record is typically called a bill of lading. It is a statement of the nature of the nature and value of goods being transported and the condition and terms applying to their transport. It serves as evidence of a contract of transport between the owner of the goods and the carrier. It may be

paper or it may take various electronic forms.

- *Routing/dispatching.* Choosing a course and directing the vehicle to its destination can be a matter of strictly human effort (for a simple truck trip) or it can be automated to nearly any extent desired.

- *Pickup confirmation, en route tracking, and delivery confirmation.* Shipping and freight companies often desire to track the progress of their shipments. A variety of processes and technologies (depending on the transportation modes) can be used for this purpose, digital or analogue wireless telephones including GPS satellites, and bar code scanning. Some carriers use all these devices, so customers may monitor the locations of their shipments in near real time by using the Internet.

- *Transmitting shipping documentation*. Paper documents are traditional here, but many carriers use electronic communications, the Internet and electronic data interchange, i.e. web-based EDI, which became the central of this research.

- *Cargo manifesting.* This step often uses special information software and systems.

Various transportation modes that require different level of technology within the internal logistical supply chain of the shipping firm itself. All, however, are moving toward greater computer-assisted systems and reliance on communication, frequently using EDI and, more recently, the web-based EDI during the operation process. In fact, there are many different types of information and technology used in the liner shipping industry, but the high-level goal is to get the shipment from its origin to its destination, which may involve multiple modes. The challenge overall is to get the shipment to its destination on schedule, with the appropriate degree of tracking en route to minimise delays in transferring from mode to mode and to do all of this at a competitive price without damage to the product shipped.

The freight transportation planning and operation decisions are often assisted by software that is designed to help analysis and determine how, where, when and in what quantity materials should be transported. These systems also are used to compare different carriers, modes, routes, and freight plans in real time to respond in real time to problems and emergencies along the supply chain of logistics. For instance, shippers (cargo owners) must arrange with the line for the specific types and numbers of container needed, the pickup date, and which vessel is to carry the containers.

To do this, the shipper either directly contacts the line's booking agent or enters the necessary information (including origin, destination, port of loading, commodity description, shipper's name, and type of container) using the appropriate transaction section of the line's web site. In either case, the information goes into the company's mainframe system and becomes available to dispatchers of containers and to vessel operators and terminal operators who make the necessary preparations for the movement, loading, and stowage of containers on the vessel and for the availability of needed equipment. At the destination port, the terminal operation staff (also working from the company's mainframe system) will access information needed for off-loading the containers and handling them off for the next leg of the journey.

In addition, a vessel may carry the cargo of various container liners in order to achieve economic scales and minimising the risks, the multi-line alliances and other vessel-sharing arrangements are central to liner shipping. Therefore, it is necessary to exchange significant amounts of information among alliance members; while most of this information exchange is handled via EDI, which in turn requires that each alliance partner's information system be programmed to accept data from the other partners' systems. Shipping liners also share information with truckers and rail carriers to ensure efficient intermodal transfers. The EDI protocol or Web tools are generally used with trucker or railroads; with smaller trucking companies, the transaction are handled by fax or e-mail.

2.6.3 The Cooperation in Modern Container Liner Shipping via Web-based EDI

Political, economic and technological changes of the past forty years have had a profound influence in container liner shipping industry and continue to shape in future. The greatest impact came from liberalisation, privatisation and containerisation of the industry, followed more recently by concentration, centralisation and the inevitable organisational changes arising from the advent of information economy (Behnam, 2004). Back in the 1960s, as a means of combating ever-increasing port costs, containerisation established itself as the predominant from of unitisation of cargos in the 1970s. Since then, it has been at the root of a number of consequential changes, refining transportation technology and adopting the organisation of liner shipping to the requirements of integrated transport (Behnam, 2004). Sophisticated computer-based management and operating information systems and EDI, provide for efficient cost control, optimum use of equipment and a new quality in customer relations in the era of e-commerce.

Today, due to competitive world driven by globalisation, global sourcing, emphasis on time and quality based on competition and their contribution to the economic and environmental uncertainty, supply chain management (SCM) has been discussed and recognised as an important concept to guarantee 'just-in-time' deliveries. Container shipping industry no longer constitutes an isolated process of moving goods from point to point, but has become an integral part of overall production and marketing process in the context of global logistics management. Considering goods nowadays are increasingly transported by container liners, involving multimodal transport and invested in integrated transport operations, much of the ocean transport dominated by only a few powerful shipping liner operators, the competitive between the liners is very obvious. Especially after the process of concentration (either through strategic alliances, mergers and acquisitions or through internal growth has led to the development of mega-carriers, grand alliances and round-the-world service providers) as well as the current economic downturn, the supply of service dramatically outweighs that of the demand. This give the major liners the power to negotiate the 'service contract' since larger shippers may negotiate their terms of contract with the ocean carrier. Often large shippers are

themselves freight forwarders, who do not operate vessels but have contracted with smaller shippers to transport the cargo from door to door. Freight forwarders are thus often both carriers and shippers with the power to negotiate terms of contract since any big shipper may be in a position reasonably to safeguard its own interests.

In addition, with the ever increasing capacity due to the exploitation of the economies of scale from the excess investment from the major container liners today, increase the competition between liners. The downward pressure for the service charge and the uncertainty of the economic outlook certainly forced global liners to cut down other inefficient ways of operation by the intensive use of information and communication technologies (Behnam, 2004). The overwhelming share of inter-continental ocean trade nowadays is delivered through major hub ports with facilities for integrating the movement of goods into inland infrastructure or for feedering other secondary ports. This brings the shipping costs as a percentage of value of trade have declined considerably over the last few decades thanks to the very important change in information technology, such as the use of EDI and Web-based EDI.

In the container liner shipping industry, that is, ocean carriers that offer scheduled services on fixed routes, it involves the greatest need to manage information and communication with others due to its complex nature. The heart of a company's information and communication process is usually a mainframe business data system, which is generally accessible over the Internet (with various levels of access to user inside and outside the company). Therefore, web-based EDI plays a significant role in supporting the exchanges for freight billing, tracking, cargo booking, sailing schedules, booking confirmation, equipment movement and electronic fund transfer, which are the key in completing the daily business transactions all over the world nowadays. Information technology has been the vehicle that facilitated the rise of the modern container shipping, enabling their capacity to extend their services into multimodal transport, physical distribution, logistics and supply chain management. Central to liner shipping companies' activities in this area is keeping track of containers and truck chassis.

In addition, a vessel may carry the cargo of various container liners in order to achieve

economic scales and minimising the risks, the multi-line alliances and other vessel-sharing arrangements are central to liner shipping. Therefore, it is necessary to exchange significant amounts of information among alliance members; while most of this information exchange is handled via EDI, which in turn requires that each alliance partner's information system be programmed to accept data from the other partners' systems. Container shipping liners also share information with truckers and rail carriers to ensure efficient intermodal transfers. The EDI protocol or Web tools are generally used with trucker or railroads.

In short, container shipping liners have been facing increasingly turbulent, fast-changing and uncertain situations. The rapidly changing environment and market forces no longer provide stability of the shipping markets. In an industry already dominated by large vessels, and global strategic alliances, the potential cost saving still left are getting smaller and smaller; the pressure to find cost saving elsewhere is growing. Technological advances and associated new inter-organisational structures, in particular, are constantly reshaping the modern liner shipping industry. Its logistical supply chain partners are busily trying to disrupt the status quo rather than persevere it. Therefore, cooperative inter-organisational relationships via web-based EDI hence became the key to be focused in how to cost-effectively managing the modern freight operation shipping process.

Hence, it could be rightly argued that the level of the cooperation in the inter-organisational relationships via web-based EDI is the key to determine whether the inter-organisational system will bring its full potential to the entire supply chain in the modern container liner shipping. Therefore, this contributes to the reason why a social and relational exchange perspective is taken (later on) to explain the web-based EDI adoption in the container shipping industry where few industries are as mature, global, and dynamic with severe competition and ever increasing uncertainty (Doi *et al*., 2000).

2.7 Challenges and New Paradigms in Web-based EDI

Web-based EDI has revolutionised the way information can be shared among organisations, resulting in a radical transformation of organisational practices in many

ways within the supply chain. The internet also promotes the inception of major directional change in inter-organisational relationships, which involves relational contracting, working partnership, and trust-based relationships. Despite different perspectives from different researchers, there has been a variety of factors that may affect an organisation's decision to adopt web-based EDI.

With the natural differences of web-based and traditional EDI in a number of aspects (communication protocols, cost, reliability and security), however, it is imperative to assess the applicability of traditional EDI literatures on the web-based EDI. For instance, Shang, Chen and Liu (2005) investigated three major factors (power, trust and vision) influencing the decision of an organisation to implement web-based EDI by using multi-case study approach and suggested that they did not find conclusive evidence showing the existence of same relationship between web-based EDI adoption and the three factors and believed that some other factors might be more important than the factors of trust, vision, and power structure, in influencing the decision to adopt web-based EDI. Similarly, in Huang, Janz and Frolick (2008)'s recent comprehensive examination of web-based EDI adoption, they concluded that some EDI-significant factors are no longer significant for web-based EDI. Since not all inter-organisational factors significantly relate to the adoption decision as technologies and organisations' experience have renovated the way people and organisations handle technologies, it is vital to focus on areas such as social and relational factors that are central characteristics of Internet and web-based EDI's collaborative role.

In fact, business-to-business network have their common interests in the inter-firm relationships and linkages when an increasingly large number of firms are using new technology, such as, EDI, for more than just operational and management support (Rackoff *et al.*, 1985). The role of web-based EDI has shifted from a competition weapon to a cooperation enabler over the last decade (Wang e*t al.*, 2005). Furthermore, since the adoption of web-based EDI requires mutual cooperation and negotiation between two firms (or more) at the same time, the technical issues become relatively insignificant compared to the inter-organisational relationship in adopting web-based EDI (King and Malhotra, 2000; Yang and Huang, 2000). The business-level relationship with trading

partners, hence, plays one key role in the web-based EDI adoption process. The considerations of the inter-firm relationships and linkages consequently become obvious. Building and maintaining the B2B inter-firm relationships, hence, becomes one major challenge that is too important to ignore (Hart and Saunders, 1998; Gottardi *et al*., 2004).

There are many components of web-based EDI adoption and their inter-relationships are complicated. For example, in the case study of Shang *et al.* (2005), they investigate factors contributing to the Internet EDI adoption and suggest that some factors might be more important than the factors of trust, vision and power structure in influencing the decision to adopt Internet EDI. Similarly, in a recent comprehensive examination of Internet-EDI adoption of Huang *et al*. (2008), it suggests that some EDI-significant factors (such as, organisational size) are no longer significant for web-based EDI and shows that not all inter-organisational factors are significantly related to web-based EDI adoption.

2.7.1 From Transactions towards Relational and Social

Basing on the assumption of an economic or efficiency view of inter-organisational relationships, most of the analysis of EDI adoption has been drawing from transaction cost theory, arguing that transaction costs can be reduced by the effects of new information technology in favouring the markets (Malone *et al.,* 1987). On the contrary, a field study by Choudhury *et al.* (1998) concludes the use of electronic markets depends on other faces of transaction apart from product complexity and specificity. Use of inter-organisational systems is found to enhance the efficiency of operations, at the same time, increase the interdependence among firms (Hart and Estrin, 1991). Other researchers have argued that use of relation-specific information systems will result in significant competitive advantage (Venkaraman and Zaheer, 1990; Zaheer and Venkatraman, 1994). For instance, in an empirical survey of the electronic markets, Choudhury (1997) found that the type of inter-organisational systems used by the firms will depend not only on transactional benefits of the market, but also on the strategic significance of the system.

It is widely accepted that cooperative supply chain relationships achieve benefits for the

participants (Christopher, 2005). However, it is also apparent that full web-based EDI adoption is not being achieved because trading partners are commonly taking a short-terms view, often during the increasing marketplace complexity and uncertainty and are limiting the extent to which they extend their collaborative focus (Fawcett and Mganan, 2002). This can often generate negative impacts to the supply chain, such as power abuse, lack of transparency, poor communications and reluctance to adapt attitudinal change (Anscombe and Kearney, 1994; Hines and Jones, 1996). Perks and Easton (2000) extend these ideas further by suggesting that supply chain management provides a business environment in which firms closely cooperate rather than compete to achieve mutual goals.

However, despite the availability of modern advanced information systems, some would still argue that the practice of managing supply chain players is wasteful of resources and drags performance backwards rather than promoting continuous improvement (Macbeth and Fergusson, 1994). It has also been criticised that achieving true supply chain integration is a difficult goal because there are many considerable complicated management problems need to be solved before it all work on top of the expensive management effort to maintain close relationship (Cooper *et al*., 1997).

Therefore, it depends upon cooperative relationships throughout the supply chain in order to achieve benefits for all participants (Stevens, 1989) and this requires closer relationships between supply partners which include trust, commitment and collaboration (Spekman *et al*., 1998). In fact, many researchers see continuity of relationship to be an important characteristic of the relationship (Dwyer *et al*., 1987; Frazier et al., 1988). This continuity usually concerns a long time period of the relationship, and is related to an anticipated future (Dwyer et al., 1987, Håkansson and Snehota 1995). Just as Halinen (1997) argues that "if companies have expectations of future exchange,..., they should be considered to have a relationship".

Thus, the relationship develops as participants make commitments and experience benefits from relational exchange. This social and relational marketing approach is to enhance marketing productivity by achieving efficiency and effectiveness (Sheth and

Parvatiyar, 1995). In other words, it is directed toward establishing, developing, and maintaining a more long-term social and relational exchange in all marketing activities (Morgan and Hunt, 1994), so that the objectives of all parties are met; and this is done by a mutual exchange and fulfilment of promises (Gronroos, 1994).

By establishing, developing, maintaining, and enhancing successful exchange relationships each other, more participants are willing to invest more resources to achieve their mutual goal. Through successful relationships, firms raise other organisation's capabilities and resources enhance sales and profits, to reduce risk in uncertainty and dynamic processing and to compete effectively (Palmatier *et al*., 2006), but because of higher levels of cooperation and reduced conflict. In alliances, there is the risk of the partner not cooperating in good faith (relational risk) in addition to the usual risk of unsatisfactory business performance (performance risk) (Das and Teng , 1999).

Therefore, the importance of long-term partnering relationships to focusing on complex problem solving (Boddy *et al*., 2000; Hulme, 1997) is acknowledged. The need to base them on openness, shared risks and rewards that leverage the skills of each partner to achieve competitive performance not achieved by the individual (Lambert *et al*., 1996) is also recognised. However, firms are still taking a relatively short-term view which tends them towards adversarial relationships (Braithwaite, 1998) and the development of partnering relationships is being obstructed by poor communications allied to reluctance to accept attitudinal change (Anscombe and Kearney, 1994). Nevertheless, the obligational nature of these arrangements to overcome opportunistic temptations is evident (Ellram and Edis, 1996) as is the importance of achieving good business-to-business relationships through partnering as a foundation for achieving the real benefits of web-based EDI adoption.

Recently, it has been argued that, relational and social-context factors should be taken into account to explain the influence of inter-organisational system (like web-based EDI) on inter-organisational relationships (Grover *et al.*, 2002; Subramani and Venkatraman, 2003; Christiaanse, 2004). A number of labels have been given to relational supply chain business dealings but generally are involved with demand-led, integrated,

inter-organisational relationships based on collaboration. These arguments are mainly based on social exchange theory (Homans, 1958) and relational exchange theory (Macneil, 1980)

Social exchange theorists (Homans, 1958; Emerson, 1962; Kelly and Thibaut, 1978) view the center of the social exchange relationship as the interaction processes between participants, in that a participant's behaviour is potentially influential to others and always invokes some response within the relationship. Relational view of the firm aims to establish, develop and maintain successful relational exchanges through the social relations that shape and define the nature of synergistic interactions between firms as firms seek closer dealing with partners to secure reduced uncertainty, managed dependence, exchange efficiency and social satisfaction (Gummesson, 1999).

Relational view of the firm is seen as a tailored business relationship based on mutual trust, openness, shared risks and rewards that leverages the skills of each partner to achieve competitive performance not achieved by individual partners (Lambert et al., 1996). The importance cooperation is also emphasised. Christopher (1997) use the term co-makership to describe a seamless end-to-end pipeline or virtual corporation between the supplier and the customer based on high quality processes, co-operation, inter-dependence, openness, trust, commitment, shared goals, open information flows and long-term mutual benefits. Cooper and Gardner (1993) describe inter-organisational relationships consisting of enduring transaction flows and linkages that come about because of a variety of reasons including asymmetry (a dominant partner), reciprocity (co-operation), efficiency (cost reduction), and stability (risk reduction).

Academics have used a number of approaches within supply chain management research to capture perspectives containing the key factors of inter-organisational, operational and inter-personal dynamics. Ellram (1991) define purchasing partnerships which are defined as long-term, trusting agreements where the risks and rewards are shared. Ellram and Edis (1996) use similar terms to describe collaborative buyer-seller relationships, although they also mention the obligational nature of the arrangement to overcome opportunistic behaviour. In addition, there has been a number of recent study suggest that the use of

Humphries, Wilding and Menas' (2009) success framework to exam its practical implementation issues and identifies the key relational success factors and the collaborative supply chain relationship between collaborating partners. Moreover, Redondo et al. (2009) concluded that the use of inter-organisational system (such as, web-based EDI) is an important tool to enable and further develop inter-firm relationships with key partners, and stated that social exchange theory is needed when there is commitment and reciprocity between partners (Cropanzano and Mitchell, 2005) as the exchange actions are interdependent and contingent on rewarding reactions from others (Blau, 1964). As a result, the continuous cycle of action and positive reaction (Kern and Willcocks, 2000) hence become the basis of the development of reciprocity in which a firm reacts to the needs of its partner as it would to its own internal needs (Redondo *et al*.,2009).

There is also an extensive literature on important social/ behavioural variables that provide valuable knowledge in improving business relationships. These include trust (Hart and Saunders, 1998), commitment (Naude and Buttle, 2000), cooperative, coordinating and collaborative (C^3 behaviour) (Humphries and Wilding, 2001), long-term orientation, interdependence (Hart and Saunders, 1998), and power (Hart and Saunders, 1998). In order to response to a more fast-moving, competitive environment, it requires a change in direction towards a more social and relational form to improve inter-organisational relationship.

Therefore, it can be argued that there is a shift in the area of inter-organisational (web-based EDI) adoption from transactions towards a more relational and social paradigm, which become the real focus in this study.

2.8 Conclusions

This chapter initially summarised the importance of the collaborative supply chain relationships through the newer form of inter-organisational system adoption (web-based EDI). By comparing and contrasting the natural difference of the traditional and web-based EDI in a number of aspects (communication protocols, cost, reliability and security), it is found that these difference creates new challenges to the pervious literatures. After reviewing the underlying principles from the literature, as well as outlining new paradigms in web-based EDI, it is understood that there is a need to focus on the closer relationships between all participants from the social and relational perspective.

It appears that only limited effort empirically validates the social and relational aspect of inter-organisational system relationships in web-based EDI. This might lead to systems failure, troubled relationships or other undesirable effects. As Jap (1999) has argued that web-based EDI has lower asset-specific investment, leads to new forms of relations exchange, allows for a rapid adoption and a relational type of exchanges mechanisms.

Therefore, the relational and social-context factors should be taken into account to explain the influence of inter-organisational system adoption on inter-organisational relationships (Grover *et al*., 2002; Subramani and Venkatraman, 2003; Christiaanse, 2004), especially in an attempt to understand concept of today's supply chain management by leveraging competence of each partner to achieve competitive performance not achieved by the individual. Ultimately, in the light of this study, would provide a better understanding of the social and relational dynamics.

Chapter 3

Theoretical Model Development

There is an extensive body of research in organisational behaviour that examines the role of inter-organisational relationships on organisational adoption decisions. By definition, inter-organisational systems (IOS) differs from intra-firm information systems in that it requires two or more organisations to agree upon its implementation; therefore, an adoption decision depends heavily on the other parties (Chan and Swatman, 1998). Proponents of social exchange or social political theory argue that exchange activity is embedded in a social context.

Repeated interaction between firms creates relational capital that influence exchange design choice. Thus, the nature of the relationship plays an important role in shaping the coordination mechanisms that are deployed in managing the relationship. Social-political factors, such as inter-firm power relationships and trust come in to play an important role in the decision making process.

In the context of inter-organisational system adoption, by allowing firms to establish one-to-many links to retain competition, the new business-to-business technology (such as, web-based EDI) is viewed as a facilitator of coordination between supply chain partners (Tan, 2001). In gaining new efficiencies, firms need to exchange large amounts of planning and operational data and move towards an extended enterprise business model (Edwards, Peter, and Sharman, 2001). That is where the web-based EDI technology comes in to support supply and demand integration enables firms to achieve higher levels of performance (Frohlich and Westbrook, 2002). So that the use of web-based EDI can facilitate frequent and automatic bi-directional information flows between supply chain partners, thus enhancing degree of coordination.

The inter-organisational relationship is described in terms of the social-political processes reflected by the 'transaction climate' that exists in the relationship and the social-political structure captured through the power-dependence relationships in the dyad (Reve and

Stern, 1986). It is suggested that a favourable climate between firms facilitates greater information flow, better inter-organisational coordination, and greater cooperation, leading to better decision making (Williamson, 1975; Dwyer, 1980; Reve and Stern, 1986).

Therefore, cumulatively, literature on inter-organisational relationship recognises that firms should employ coordination mechanisms that can effectively solve governance problems, such as the transactional environment and relational orientation between the transacting parties. Different theoretical perspectives also show commonality in the exogenous variables that influence governance choice. Transactional and relationship context is proposed as the main source of coordination needs, which have to be matched with appropriate coordination mechanisms for efficient and effective inter-organisational systems.

Chapter Three initially review some of the major theoretical approaches in inter-organisational system adoption. It is then discussed in more detail on the role of social and relational constructs by comparing and contrasting the social and relational exchange theory, explaining how those key social and relational constructs are derived from and shows why social and relational aspects are the key areas in adopting web-based EDI. Consequently, the conceptual model and a set of hypotheses are derived, followed by the conclusions.

3.1 Review of Major Theoretical Approaches

Being part of the inter-organisational systems, EDI has been extensively studied using several theoretical perspectives. Studies of inter-organisational system adoption by organisations rely primarily upon Rogers' (2003) classical theory of diffusion of innovations, related theories of technology acceptance and adoption model, transactional costs economics, resource-based view of the firm, resource dependency theory and social exchange theory, and so on, which will be reviewed in more details in the following sections.

3.1.1 Innovation Diffusion Theory

The innovation diffusion theory (IDT) is concerned with how innovations spread and consists of two closely related processes: the diffusion process and adoption process (Rogers, 1995). Diffusion is a macro process concerned with the spread of an innovation from its source to the public whereas the adoption process is a micro process that is focused on the stages individuals go through when deciding to accept or reject an innovation. The aggregate adoption process is subsequently an S-shaped function of time. Key elements in the entire process are the innovation's perceived characteristics, the individual's attitude and beliefs, and the communication received by individuals from their social environment. In relation to the factors pertaining the innovation, factors such as, relative advantage, complexity, trialability, observability and compatibility were considered important in influencing individual's acceptance of the innovation (Rogers, 1995). The IDT has been used, for example, to explain Internet-based service adoption.

IDT is also a fundamental approach to the study of the adoption of new technologies, which has been, either explicitly or implicitly, a foundation for much of EDI research (e.g., Premkumar *et al.*, 1994; Teo *et al*., 1995). The focus of innovation diffusion theory research is the characteristics of the individual technology under study that either encourage or inhibit adoption. For instance, Premkumar *et al*. (1994), in a survey of EDI adopters, found that relative advantage and compatibility are predictors of the extent of adaptation – the degree of EDI usage in its first application (operationalised as either purchase orders or invoices). Teo *et al*. (1995) used innovation diffusion theory to predict intent to adopt financial EDI in Singapore and found that complexity is a strong predictor of intent to adopt.

In addition to the technological perspective, innovation diffusion theory has also explained a portion of the EDI adoption decision, based on individual-level adoption decisions. However, web-based EDI adoption is usually an organisational-level decision executed in an inter-organisational context; therefore, there are certainly aspects of the EDI adoption decision that are not captured by looking solely at the technology of EDI.

Thus, much of the research on EDI has taken an organisational approach, considering organisational characteristics. In fact, organisational adoption of a technological innovation can be positioned within a much larger body of innovation research conducted by economists, technologists, and sociologists focus on the attributes of the innovation, and propose relationships between these attributes of adoption, acknowledging that some attributes of a particular technology will vary across organisations (such as perceived benefits).

Empirically, innovation diffusion theory has also been used to explain the decision of any individual or organisation to make use of an innovation (Frambach and Schillewaert, 2002). In the previous literature, the theory has also been used to identify the many factors that facilitate or inhibit technology adoption and implementation (Premkumar *et al.,* 1997; Ranganathan et al., 2004), emphasises that adoption can be based on the perceived characteristics of the innovation.

Despite the determinants of innovation is vary depending on context, it is normally explained through two important stages: adoption and diffusion (Rogers, 1995). In the adoption stage, the firm collects information, builds knowledge of the innovation, examines its relevance and appropriateness to the organisation and makes a decision whether to adoption the innovation. After that, in the second stage (the diffusion state), the innovation is implemented, and its usage is diffused among users over a period of time.

Theories using this innovation diffusion theory perspective illustrated that the adoption of an inter-organisational system is dependent on three main groups of factors: nature of the technology adopted, the adopting organisation, and the inter-organisational relationships (Kurnia and Johnston, 2000). First, the nature of the adopted technology may create difficulties that inhibit successful adoption. For example, the adoption may generate security concerns (in the case of web-based EDI) as well as the complex and expensive integration issues (in the case of traditional EDI). Furthermore, when organisations adopt new innovations, it is, in general, only when they offered better benefits compared with previous situation (Rogers, 1995). In addition to the benefits, the

compatibility of the new technology with the existing organisational procedures, values, systems, and top management support are mostly perceived as relevant aspects of the new innovation and adoption (Iacovou *et al*., 1995; Chwelos *et al.*, 2001).

Moreover, other organisations may set on the focal organisation to enhance or inhibit the adoption; hence, the relationship with other organisations as the use of the technology can have a major impact on the inter-organisational relationships. This view is echoed by the finding of Chwelos *et al.* (2001) stated inter-organisational factors are antecedents of all other factors that influence inter-organisational system adoption. In addition, competitive pressure, power, trust have been found to influence EDI adoption since powerful organisations can induce its partners to adopt by providing benefits or by forcing them to adopt it with the threat of abandoning the partners if it rejects. However, IDT factors are found to be insignificant by Bouchard (1993), and Bouchard (1993) argued that business partners' behaviour is significant in inter-organisational system adoption decisions.

Hence, according to innovation diffusion theory, inter-organisational factors (such as power, trust, and dependence) would certainly play one important role in the study of the adoption of new technologies. Factors such as perceived benefits, compatibility of the new technology with the existing organisation, and top management support can be part of a social and relational view of the firm regarding to business partners' behaviour might be more important than those of innovation diffusion theory factors in the latest inter-organisational system adoption.

3.1.2 Technology Acceptance Model

Besides IDT, an important area of research is the user's perception on the technology. Most of the studies on technology adoptions from users' perception have commonly adopted the Technology Acceptance Model (TAM) as TAM posits that perceived usefulness and perceived ease of use determine an individual's intention to use a system with intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use. In Davis (1989)'s technology acceptance model, he argued that perceived usefulness and perceived ease of use determine an individual's intention to use a system with intention to use serving as a mediator of actual system; while perceived usefulness is also directly affected by perceived ease of use (Davis, 1989).

The main advantage of this model over others is that the two related beliefs can generalise across different settings. Thus, some argue that it is the most robust, parsimonious and influential model in explaining information technology through validations, applications and replications for its prediction power (Taylor and Todd, 1995; Venkatesh and Morris, 2000). A number of modified TAM models were proposed to suit new technologies including Internet and intranet (Hernandez *et al.*, 2008), adoption behaviour (Venkatesh *et al.*, 2003) with extensive empirical support.

Although being a popular model, TAM is sometimes criticised for being too simple to explain a wide range of technologies, or adoption situations (Bagozzi, 2007), also with a major criticism of strong behavioural elements (similar to innovation diffusion theory), assuming that when someone forms an intention to act, and its practical constraints (such as, limited ability, time, environmental or organisational limits, and unconscious habits).

Criticisms of TAM as a 'theory' include its questionable heuristic value, limited explanatory and predictive power, triviality and lack of any practical value (Chuttur, 2009). Benbasat and Barki (2007) suggest that TAM "has diverted researchers' attention away from other important research issues and has created an illusion of progress in knowledge accumulation. Furthermore, the independent attempts by several researchers to expand

TAM in order to adapt it to the constantly changing IT environments has led to a state of theoretical chaos and confusion" (Benbasat and Barki, 2007). In addition, according to Dillon and Morris (1996), one major theoretical limitation of TAM is the “exclusion of the possibility of influence from institutional, social, and personal control factors” (Dillon and Morris 1996, p49). Thus, the suitability of the model for predicting general individual acceptance needs to be re-assessed as the main TAM constructs do not fully reflect the specific influences of technological and usage-context factors that may alter user acceptance (King *et al.*, 1994; Taylor and Todd, 1995).

In general TAM focuses on the individual 'user' of a computer, with the concept of 'perceived usefulness', with extension to bring in more and more factors to explain how a user 'perceives' 'usefulness', and ignores the essentially social processes of Information System development and implementation, without question where more technology is actually better, and the social consequences of Information System use.

In response to this, a number of modifications and changes to the original TAM models have been made. An alternative model that is built on TAM’s foundation is the UTAUT model (Venkatesh *et al.*, 2003).

3.1.3 United Theory of Acceptance and Use of Technology

United Theory of Acceptance and Use of Technology (UTAUT) was developed through a review and consolidation of the constructs of eight models that earlier research had employed to explain new information technology usage behaviour (theory of reasoned action, technology acceptance model, motivational model, theory of planned behaviour, a combined theory of planned behaviour/technology acceptance model, model of PC utilisation, innovation diffusion theory, and social cognitive theory).

This unified model that integrates constructs across eight models provides a 'refined' view of how the determinants of intention and behaviour evolve over time and assumes that there are three direct determinants of intention to use (performance expectancy, effort expectancy and social influence) and two direct determinants of usage behaviour (intention and facilitating conditions). UTAUT aims to explain user intentions to use an information system and subsequent usage behaviour. The theory holds that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behaviour (Venkatesh *et al*., 2003). Gender, age, experience, and voluntariness of use are posited to moderate the impact of the four key constructs on usage intention and behaviour (Venkatesh *et al*., 2003).

Despite the subsequent validation of UTAUT in a longitudinal study found it to account for an impressive 70% of the variance in BI and about 50% in actual use, both UTAUT (and TAM) have received criticisms with the fundamental one being about the problem in applying these models beyond the business/ organisational context (Carlsson *et al.*, 2005). This criticism is applicable to WEDI adoption as these are used across the business organisational boundaries.

The increasing complexity with each revision of the model was also starting to attract vocal criticisms towards it. Bagozzi (2007) recognised the wide adoption of Davids's (1989) original model and its later extensions, but at the same time pointed out several shortcomings. One of the points he made was the fact that the latest UTAUT revision adds so many different variables that it made the whole model difficult to use since the model

had become somewhat too large and difficult to grasp. Bagozzi (2007) stating "UTAUT is a well-meaning and thoughtful presentation," but that it presents a model with 41 independent variables for predicting intentions and at least 8 independent variables for predicting behaviour," and that it contributed to the study of technology adoption "reaching a stage of chaos." He proposed instead a unified theory that coheres the "many splinters of knowledge" to explain decision making (Ba and Pavlou, 2002).

More recently, van Raaij and Schepers (2008) further criticised that in trying to incorporate multiple models into one, UTAUT actually became a complex system whose individual constructs (specifically social influence and facilitating conditions) were combinations of too many different factors and therefore representative of none. They also claimed that the 70% explanatory power is only achieved by introducing the moderating elements, so inherently the model was not much better than TAM or TAM2.

Although the UTAUT model was a further improvement from TAM2, there were still clear limitations and even drawbacks that came with the added complexity (Bagozzi, 2007). Although UTAUT reportedly explained up to 70% of variance in usage, one of the limitations the authors reported has to do with the practicalities and the way the analysis was conducted: According to Venkatesh *et al*. (2003), they only used those research questions, whose answers carried most weight in analysing each of the core constructs (eg. performance expectancy, effort expectancy etc.). What this effectively meant is that sometimes the richer and more diverse items in one or more of the eight underlying models were discarded due to their limited impact, thus resulting in lesser representativeness and validity of the findings.

3.1.4 Transactional Cost Economics

In inter-organisational systems research, transaction cost economics (TCE) has been used to build its case by asserting that information technology reduces coordination costs, transaction risk, ultimately resulting in efficiency gains (Malone *et al*., 1987; Clemons *et al*., 1993). Transaction cost economics considers the transaction as the unit of analysis and proposes that the most efficient boundaries between firms and market can be determined based on the most economical form of transaction (Williamson, 1981). Transaction cost economics states that organisations need to consider the transaction costs of managing relationships and interactions with suppliers (Chan *et al*., 2007) to decide what is more cost effective either sourcing from the open market or conducting the activity within the firm. Therefore, transaction cost economics tend to concentrates on the need to minimise the cost of transaction and focus on adopting appropriate forms of governance to minimise the risks associated with opportunistic behaviour.

Many studies on the success of traditional EDI have foundations in transaction cost economics (Williamson, 1975). This theory states that business partners often do not trust each other because they have a higher self-interest than in the success of an alliance. To reduce the cost of self-interest and improve the degree of trust, business partners need to employ mechanisms, such as contact, negotiation, and contract, as well as monitoring, inspection, and assurance. Therefore, transaction cost is the cost also associated with these mechanisms. Five general attributes can influence the transaction cost: asset specificity, uncertainty of transactional environment, frequency of transaction, degree of trust, and risk attitude of business partners. EDI can lower transaction cost by improving these five attributes.

In line with other research (Grover *et al.*, 2002; Markus and Christiaanse, 2003), this approach creates several problems that needs to be mentioned when applying in web-based EDI adoption. The first problem is that the (sales) transaction is the unit of analysis, instead of the exchange relationship. As opposed to other aspects of inter-firm relationships, transaction cost economics theory has too narrow a focus on sales transaction that has characterised information system research for decades (Grover et al.,

2002). As firms function in supply chain relationships, and not in 'transaction vacuums' , it can be argued that there are clearly many other functions that web-based EDI can perform beyond the sales transaction itself (such as, fulfilment, logistical or transportation arrangements). Obviously, these functions depend on the nature of the transaction and the relationship. For instance, *Christiaanse et al.* (2004) pointed out that transaction cost economics are too limited to help us to understand both the complex relationship structures and the economic and political consequences.

The second problem with applying transaction-cost logic to the adoption of web-based EDI is that, as previously mentioned in the beginning of Chapter two, nowadays, the adoption of inter-organisational system in the supply chain management has been moving increasing from transaction-oriented towards collaborative supply chain. The nature of the governance structure for web-based EDI adoption depends on a number of factors (not simply transaction only). Not only had the open and inter-organisational nature of the web-based EDI shifted from a competition weapon to a cooperation enabler over the last decade (Wang et al., 2005), which requires mutual cooperation and negotiation between two firms at least, but also the technology characteristics of web-based EDI shifts the research focus into building and maintaining the inter-organisational relationships and linkages become obvious (Hart and Saunders, 1998; Gottardi *et al*., 2004). Explaining the relationship between organisations from a purely economic point of view is quite limited, because inter-organisational relationships evolve through social learning experiences as partners interact (Lee and Lim, 2005).

In addition, the limited focus of transaction cost economics on short-term cost minimisation results in the ignorance to consider other important criteria, such as social issues and relational aspects within the relationship. In particular, Allen *et al.* (2000) argues that the additional relational and operational uncertainties and the resulting information openness that arises with electronic access can potentially subject members to the opportunistic threats, growing interdependency and vulnerability (Hart and Saunders, 1997) that inter-organisational system enforces. Over time, as proprietary EDI standards have been supplanted by the more open standards of the Internet and XML technologies, which are characterised as low asset specificity, transaction cost economics

appears to become insufficient to explain the persistence of organisational governance (Robey *et al.,* 2008).

All these problems have led researchers recently to argue for closer attention to the socio-political (Reekers and Smithson, 1996) or relational (Hart and Saunders, 1997) perspective to inter-organisational system. Successful partnerships tend to show some behavioral characteristics (e.g., commitment and trust) that help guide the flow and the complex interchange of information between partners. The existence of these attributes indicates a willingness to work for the continuation of the relationship (Lee and Lim, 2005).

To conclude, transaction cost economics continues to provide valid theories, however, over time, transaction cost economics only able to explain these conditions so far as they represent short-term, unnatural phenomena (Williamson, 1996). In particular, it ignores the relational aspects of cooperation, such as, trust, which evolve over time and change the nature of the transactions themselves (Faulkner and de Rond, 2000). Nevertheless, transaction cost economics states that organisations need to consider the transaction costs of managing relationships and interactions with supplier. This has led researchers recently to argue for closer attention to relational (Hart and Saunders, 1998) perspective to inter-organisational system.

3.1.5 Resource-Based View of the Firm

Overall, the central theme of Resource-Based View of the Firm (RBV) addresses the fundamental question of why firms are different and how firms achieve and sustain competitive advantage by deploying their resources. In contrast to the transaction cost logic, which emphasises cost minimisation, the resource-based view of the firm emphasises value maximisation of a firm through pooling and utilising valuable resources.

According to this approach, the sources of sustained competitive advantage are firm's resources that are valuable, rare, difficult to imitate, and difficult to substitute (Mowery *el al*., 1998). Such resources maybe physical (such as, product designs and production techniques) or intangible (such as, brand equity). Therefore, the resource-based research on innovation is based on the fundamental premise that organisational resources and capabilities are those that underlie and determine a firm's capacity for innovation. Within this perspective, organisational resources (tangible and intangible) are taken to provide the input that, in turn, is combined and transformed by capabilities to produce innovative forms of competitive advantage.

The resource-based view also suggests that differences in firm's performance are related to variances in firm's resources. However, the increasing complexity of markets makes it difficult for firms to have all of the resources required to compete. Thus, the trading and accumulation of resources becomes a strategic issue. Some would argue that access to resources is the primary reason for alliances and other types of cooperation.

Resource-based view also considers inter-organisational cooperation activities (such as EDI adoption) as strategies used to access other firms' resources and to retain and to develop one's own resources by combining them with others' resources for garnering otherwise unavailable competitive advantages and values to the firm. Access to external complementary resources became critical to make innovation a successful strategy for a firm (Teece, 1986).

Cooperation activities in the supply chain may have a positive influence on the adoption

and use of information technologies such as EDI. Companies that cooperate with trading partners are able to benefit from their experiences with information technologies, and thus, they may be more favourable to adopt these inter-organisational technologies and to use them in the business-to-business context. However, over the last decade, much of the literature has emphasised resources internal to the firm as the principal driver of firm profitability and strategic advantage. This transition in academic and managerial attention from an economic view towards a resource-based view of strategy has occurred for several reasons.

First, the rate of change in terms of new products, new technology, and shifts in customer preferences has increased dramatically. In other words, formulating strategy in an increasingly dynamic business environment is no more an adequate means to use (Bettis and Hitt, 1995). Secondly, through the adoption of inter-organisational system, traditional industry boundaries are blurring as many industries converge or overlap, especially in information technology-related industries (Bettis and Hitt, 1995). Finally, the increasing rate of change has put increasing pressure on firms to react more quickly, as time is often seen as source of competitive advantage (Stalk and Hout, 1990).

All these reasons suggest that firms may look inwardly for strategic opportunities, while, at the same time, must reconceptualise how they think of industries and define competitors. Nevertheless, RBV consider the access to external complementary resources became critical to make innovation a successful strategy for a firm (Teece, 1986), therefore, it indicates the need to look for other theories (such as, resource dependence theory or social exchange theory) that is better adopted by the fast-changing business environment and perhaps better explained the essence of web-based EDI adoption.

3.1.6 Resource Dependency Theory

Resource Dependency Theory (RDT) characterises the links among organisations as a set of power relations based on exchange of resources. The generalisation of the power-based arguments can be from intra-organisational relations to relations between organisations by social exchange theorists and political scientists. RDT considers that actors lacking in essential resources, therefore, will seek to establish relationships with (i.e., be dependent upon) others in order to obtain needed resources. Also, organisations attempt to alter their dependence relationships by minimising their own dependence or by increasing the dependence of other organisations on them.

Within this perspective, organisations are assumed to be consisted of internal and external coalitions that emerge from social exchanges that are formed to alert their structure and patterns of behaviour to acquire and maintain needed external resources. In this case, the environment usually poses the problem of organisations facing uncertainty in resource acquisition as organisations are also assumed to work toward two related objectives: one is to acquire control over resources that minimise their dependence on other organisations; and control over resources that maximise the dependence of other organisations on themselves. Attaining either objective is thought to affect the exchange between organisations, thereby affecting an organisation's power. In another words, RDT argues that by modifying an organisation's power with other organisations, the needed external resources will be acquired by decreasing the organisation's dependence on others or by increasing other's dependency on it by.

In inter-organisational system adoption literature, interdependence between organisations is the focus of RDT, which illustrated the analogy between power and dependence across all forms of social relationships. It also acknowledges that a single organisation cannot produce or own all the required resources for its operations alone; the organisation hence is forced to acquire these resources from several other actors and organisations in its environment (Emerson, 1962). Various authors found that the power structure within inter-organisational relationships can eliminate the power of larger organisations and forced small organisations to follow. Therefore, one would argue the

intensive use of inter-organisational system leads to a shift in the relationship between organisations to a reciprocal interdependence.

Researchers have identified and categorised components affecting the inter-firm exchange processes in different ways. For instance, Zhu *et al.* (2002) use a technological, organisational and environmental context to build up a framework for a cross-country study of e-business adoption. These approaches are supported by research on inter-firm links of both formal and informal relationships. Some use relational and structural embeddedness in research about the steel and semiconductor industries (Rowley et al., 2000). In conjunction with inter-organisational system and marketing research, scholars use structural and social bonds (Mattson, 1985; Wilson and Vlosky, 1998) or technical and social relationships (Perry et al., 2002).

3.1.7 Social Exchange Theory

Originally developed for analysing exchange mechanisms in interpersonal relationships within a social environment, social exchange theory (SET) was rooted in Structural Anthropology, Behavioral Psychology, Utilitarian Economics, Sociology, and Social Psychology and was developed to understand the social behaviour of humans in economic undertakings (Homans, 1958). Rather than considering exchanges between two organisations, social exchange theory considers the exchanges between specific individual actors and characterises these as 'actions contingent on rewarding actions from others' (Blau, 1964).

Social exchange theorists (Homans, 1958; Emerson, 1962; Kelly and Thibaut, 1978) view the center of the social exchange relationships as interaction processes between participants, in that a participant's behaviour is potentially influential to others and always invokes some response within the relationship. For this reason, the resultant outcome of a participant's behaviour is dependent upon other participant(s)' responsive behaviour within the exchange relationship (Anderson and Narus, 1984).

The fundamental difference between economic exchange and social exchange theory is in the way, so called, 'actors' are viewed. Exchange theory views actors (person or firm) as 'dealing not with another actor but with a market' (Emerson 1987, P.11), responding to various market characteristics; while social exchange theory views the exchange relationship between specific actors as 'actions contingent on rewarding reactions from others' (Blau 1964, P.91). Exchange theories make use of the concepts of *rewards* and *costs* (originally derived from behavioural psychology) and *resources* (originally derived from economics) when discussing the foundation of the interpersonal exchange.

Rewards and resources refer to the benefits exchange in social relationships. Thibaut and Kelley (1959) use *rewards* to refer to pleasures, satisfactions, or gratifications person enjoys from participating in a relationship; they use *costs* to refer to factors that inhibit or deter the performance of behaviour. Resources, on the other hand, are any commodities, material or symbolic, that can be transmitted through interpersonal behaviour (Foa and Foa, 1980) and give one person the capacity to reward another (Emerson 1976).

Furthermore, Thibaut and Kelley (1959) suggest that the *outcomes* (relational or interactional) or consequence of each individual in the dyad is dependent on the rewards received and the costs incurred. These three terms specifically, but not exclusively, come into play during relationship determination.

The costs of social exchange relationships can involve punishments experienced, the energy invested in a relationship, or rewards foregone as a result of engaging in one behaviour or course of action rather than another (Blau, 1964). Satisfaction with an exchange relationship is derived, in part, from the evaluation of the outcomes available in a relationship. Outcomes are equal to the rewards obtained from a relationship minus the costs incurred. Although it is generally the case that the higher the level of outcomes available, the greater the satisfaction, these concepts are not equivalent. To account for satisfaction, both the experiences of the outcomes derived from the relationship and the expectations that individuals bring to their relationships are taken into account (Thibaut and Kelley, 1959).

According to exchange theorists, satisfaction with a relationship alone does not determine the likelihood that a relationship will continue. Thibaut and Kelley (1959) developed the concept of comparison level of alternatives (CLalt), defined as the lowest level of outcome a person will accept from a relationship in light of available alternatives, to explain individuals' decisions to remain in or leave a relationship. In another word, CLalt is an individual's assessment of the outcomes available in an alternative to the present relationship. When the outcomes available in an alternative relationship exceed those available in a relationship, the likelihood increases that person will leave the relationship. Hence, staying in or leaving a relationship is not simply a matter of how rewarding that relationship is. Relationships that are rewarding are more likely to be stable because a high level of outcomes reduces, in terms of expectations, the likelihood of a better alternative existing. However, unsatisfactory relationships, in turn, may remain stable for the lack of a better alternative.

The concepts of relationship and exchange are not opposites; the exchange of products, information and technology together with social exchange takes place within the relationships (Hakansson, 1982). Dwyer *et al.* (1987) make a distinction between discrete

exchanges and relational exchanges. Discrete exchange relationships refer to the discrete transactions where the buyer often changes the supplier. Relational exchange, in turn, can be seen as exchange relationships where continuity and social aspects of relationship become important (Dwyer *et al.*, 1987; Frazier *et al*., 1988).

Despite business relationships is defined as "a mutually oriented interaction between two reciprocally committed companies", this definition limits the number of business relationships, because not all the partners are willing to or even need to be committed to the relationship. Therefore, business relationships can be regarded as being relational exchange relationships.

In fact, business relationships as relational exchange relationships are described in Hakansson and Snehota (1995) and relationship marketing literature. The differences between these approaches originate partly from the nature of partners in the relationships. The earlier approach describes the partners in relationships as companies not individuals. In relationship markets the relationships exist between the companies and the individuals. In business relationships the partners can be regarded as being more equal than in consumer relationships where the individual customer is one of the partners. In business relationships, the formation of commitment and trust can be seen as a different from the consumer relationships, for example, the investments made in the relationship can play a more important role in a business relationship as a means for building commitment than in a consumer relationship. The business relationships can be further divided into relationships, in which the partners are the buyer and the seller (or customer and supplier) and also into relationships between company and its different stakeholder groups, for instance investors and banks. Consequently, in addition to vertical relationships, i.e. buyer-seller relationships, and horizontal relationships also exist (Hakansson and Snehota, 1995; Hakansson, 1982).

The nature of social exchange is considered that one or both partners received benefits in some exchange, but not in economic form. Social exchange theory based interaction approach and evolved in growing out of the intersection of economics, psychology and sociology. As business occur in two or more parties, each with something to exchange,

and both able to carry out communications and distribution exchange is, therefore, referred as an exchange of resources or values between two or more parties with the expectation of some benefits. The motivation to become involved in an exchange is to satisfy needs (Houston and Gassenheimer, 1987).

So what factors does the relationship drive? The relationship arises through exchange processes between the parties. The positive inducements they offer each other in the primary feature of the exchange processes. Consumers engage in relational marketing behaviour by conforming to social norms in order to avail themselves of the benefits of socialisation and to avoid conflict. Mutuality is an important aspect of the exchange process, the parties demonstrates that they respect each other's interest. A lasting relationship may emerge if the parties perceive a certain complexity or heterogeneity in exchange. This implies that a number of rather weak and long-term criteria enter into and become critical in the evaluation of the exchange. A situation emerges which is similar to what Blau (1968) has characterised as social exchange. He describes how a relationship evolves in such a case: "social exchange relations evolve in a slow process, starting with minor transactions in which little trust is required because little risk is involved and in which both partners can prove their trustworthiness, enabling them to expand their relation and engage in major transactions" (Blau, 1964). In single exchanges, relationships are in this case integral parts of a process in which the parties gradually build up a mutual trust in each other. In supplier-customer relationship business exchange, however, is important aspect of this social exchange process. The social exchange process implies not only a learning process, but also an adaptation process. As the parties adapt to each other and influence each other to adapt (Johanson and Mattsson, 1987). This is a vital characteristic of the relationship.

Although social exchange theory was originally proposed in the context of interpersonal relationships, many of its propositions are well suited for analysing the inter-organisational exchange relationship between two firms (i.e. web-based EDI adoption). For instance, Lee and Lim (2005) have mentioned in their study of partnership attributes' impact on EDI implementation that social-exchange theory can be applied to explain the strategic partner relationship in such fields as information system outsourcing

(Lee and Kim, 1999) and the use of inter-organisational systems (Hart and Saunders, 1998). Accordingly, studies in marketing channels research have relied heavily on social exchange theory in building models of the exchange relationship between two adjacent firms in the value chain. Viewing a dyadic relationship between two firms as an exchange relationship via interaction processes, they regard the outcomes of certain actions taken by a firm are largely dependent on the responses of the other firm in the exchange relationship.

Although social exchange theory exists in many forms, all of them are driven by the same central concept of actors exchanging resources via a social exchange relationship where social exchange is the voluntary transfer of resources between multiple actors (Cook, 1977). Social exchange theory is best understood as a framework for explicating movement of resources, in imperfect market conditions, between dyads or a network via a social process. The theory has evolved from a dyadic model to a network model (Cook, 1977) with market properties.

Generally speaking, explaining the relationship between organisations from a purely economic/ personal point of view is simply too limited, because inter-organisational relationships evolve through social learning experiences as partners interact (Lee and Lim, 2005). Previously, power-political theory or social-exchange theory has been applied to explain the strategic partner relationship in areas as the use of EDI (Hart and Saunders, 1997; Hart and Saunders, 1998). In addition, successful partnerships tend to show some behavioural or relational characteristics (e.g., commitment and trust) that help guide the flow and the complex interchange of information between partners (Lee and Lim, 2005). The existence of these attributes may indicate the willingness to work for the continuation of the relationship. For instance, according to Emerson (1962), power is the property of a relation and not of an actor, because it “resides implicitly in the other’s dependency” (Emerson 1962, p32). In addition, the notions of interpersonal trust and bonds and cooperation should also be included in a consideration of inter-organisational relationships where social participants have a single principle of action to maximise their realisation of interests.

Therefore, social exchange theory is a powerful and dynamic tool, which is the key foundation of this thesis in order to better reflecting the nature of the open standard inter-organisational system – web-based EDI.

3.1.8 Conclusion

Following the previous theoretical review on the inter-organisational system adoption, we can summaries the conclusion as follows:

Being of the dominant paradigm in innovation studies, Innovation Diffusion Theory (IDT) has indicated the important role of inter-organisational factors (such as power, trust, and dependence) in the study of the adoption of new technologies. It has been argued that business partners' behaviour might be more important than those of IDT factors in the latest inter-organisational system adoption. Factors such as perceived benefits, compatibility of the new technology with the existing organisation, and top management support can be part of a social and relational view towards the understanding of web-based EDI adoption.

Similar to innovation diffusion theory, Technology Acceptance Model (TAM) has been using strong behavioural elements (perceived usefulness and perceived ease of use) to determine the adoption of technology at individual level, assuming nothing-else but the two behavioural elements can perfectly explain individual's intention in adopting new technology, forgetting some practical constraints (such as, limited ability, time, environmental or organisational limits, and unconscious habits). Similarly, although United Theory of Acceptance and Use of Technology (UTAUT) was developed through a review and consolidation of the constructs of eight models that earlier research had employed, both UTAUT (and TAM) have received criticisms with the fundamental one being about the problem in applying these models beyond the business/ organisational context. There are still clear limitations and even drawbacks that came with the added complexity. Hence, there is a need to look for other perspectives in the at organisation level in examining an open inter-organisational system adoption – Web-based EDI. Nevertheless, technology acceptance model has considered, perceived usefulness (or

benefit) is one key, which has a direct impact towards individual's intention to adopt new technology.

In addition, despite Transaction Cost Economics (TCE) provides valid theories, the limited focus of TCE on short-term cost minimisation results in the ignorance to consider other important criteria, such as social issues and relational aspects within the supply chain relationship. TCE only able to explain conditions that is concentrating in short-term, unnatural phenomena. Just as Allen *et al*. (2000) argues that the additional relational and operational uncertainties and the resulting information openness that arises with electronic access, can potentially subject members to the opportunistic threats, growing interdependency and vulnerability (Hart and Saunders, 1997) that inter-organisational system enforces. Consequently, over time, as proprietary EDI standards have been supplanted by the more open standards of the Internet and XML technologies, which are characterised as low asset specificity. Therefore, TCE appears to become insufficient to explain the persistence of organisational governance (Robey *et al.*, 2008). Nevertheless, TCE states that organisations need to consider the transaction costs of managing relationships and interactions with supplier. This has led researchers recently to argue for closer attention to the socio-political (Kumar and Dassel, 1996; Reekers and Smithson, 1996) or relational (Hart and Saunders, 1997) perspective to inter-organisational system.

Resource-Based View of the Firm (RBV), on the other hand, focuses on the importance in accessing to external complementary resources, which has become the key to make innovation adoption a successful strategy for a firm. Other resource-related theory (such as, resource dependence theory or social exchange theory) would be also examined in gaining better understanding of the essence of web-based EDI adoption in the fast-changing business environment.

Emerged from social exchange theory, resource dependency theory argues that by modifying an organisation's power with other organisations, the needed external 'resource' can then be acquired by decreasing the organisation's dependence on others or by increasing other's dependency on it by. Whereas social exchange theory views the centre of the social exchange relationship as the interaction processes between

participants, in that a participant's behaviour is potentially influential to others and always invokes response within the relationship. In another words, resultant outcome of a participant's behaviour is dependent upon the responsive behaviour by the other participant(s) within the exchange relationship.

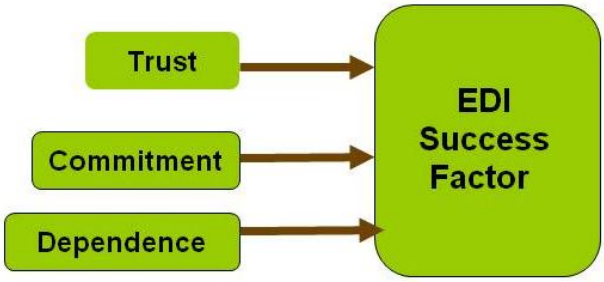
Therefore, based on the review of major theories in inter-organisational system adoption, it appears that there is a strong theoretical foundation which leads to a social and relational approach to understand the role of web-based EDI adoption, especially towards the three important and recent finding as follows.

3.2 Key Empirical Finding of Social and Relational Measurement

3.2.1 Lee and Lim (2005)

Previously in Lee and Lims' (2005) study of how partnership attributes' impact on EDI implementation and performance, they found partner trust, interdependence, and commitment can affect the extent to which companies undertake EDI integration and increase the percentage of EDI exchange and performance (see Figure 3.1). This suggests that high-quality trading partner relationship can significantly impact trading partner's EDI or web-based EDI adoption because unless the trading partners feel that the system is beneficial and compatible with their organisation, they participate in system development and faithfully devote their time and resources to the system. Furthermore, the maintenance of relations will be mutually beneficial only when each of the parties exerts a high degree of interdependence and commitment.

Figure 3.1: Lee and Lim (2005)



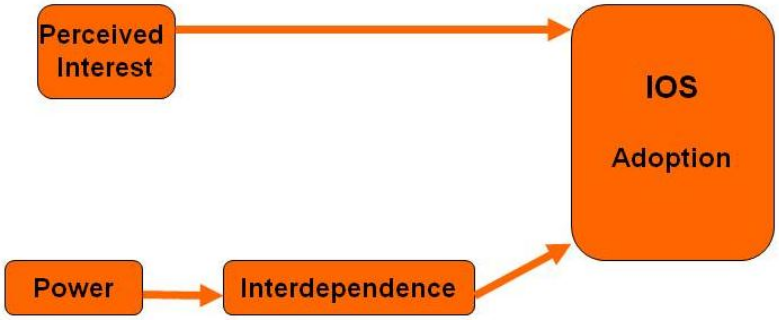
Source: adopted from Lee and Lim (2005)

3.2.2 Boonstra and de Vries (2005)

By using multiple case studies, Boonstra and de Vries (2005) present a model to describe and analyse inter-organisational systems from a power and interest perspective of multiple parties. It concludes with the assertion that the scope for the design of an effective inter-organisational systems depends on a combination of technical, economic and social factors. In particular, they suggested "main source of power in relation to inter-organisational system is closely related to technological supremacy and market dominance. At the same time, power is also connected to the degree of interdependence among inter-organisational system parties regarding whether or not to implement and use the inter-organisational system" (Boonstra and de Vries 2005, p498). Hence, it

appears that the power, interdependence, and perceived interest can significantly impact trading partner's inter-organisational system or web-based EDI adoption (See Figure 3.2).

Figure 3.2: Boonstra and de Vries (2005)

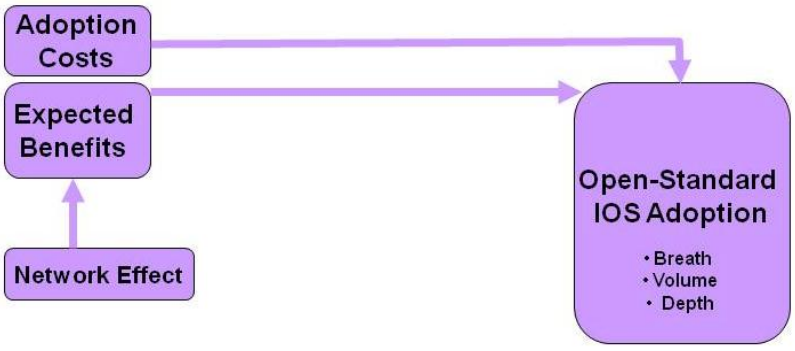


Source: adopted from Boonstra and de Vries (2005)

3.2.3 Zhu *et al.* (2006)

Based on a large data set of 1,394 firms, Zhu *et al.* (2006) present a conceptual model that features network effects, expected benefits, and adoption costs as prominent antecedents (see Figure 3.3). The empirical results demonstrate the significant impacts of network effects on open-standard inter-organisational system adoption, highlighting the network effects and expected benefits from open standards are significant drivers of migration to open-standard inter-organisational system, such as web-based EDI.

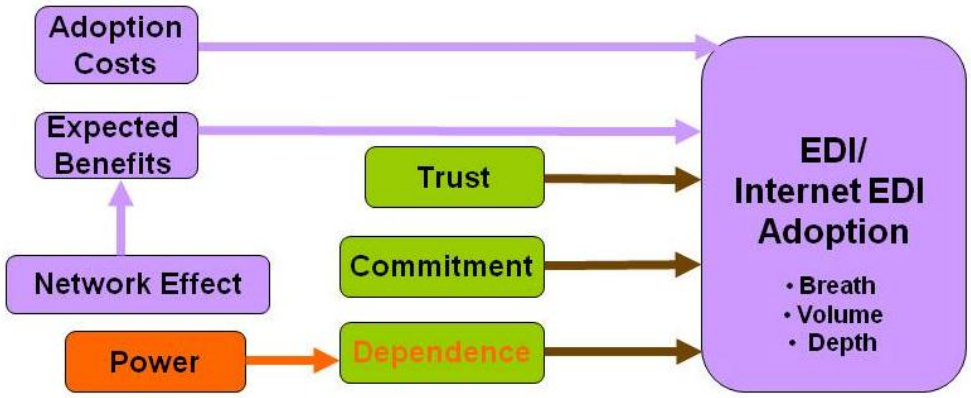
Figure 3.3: Zhu *et al.* (2006)



Source: adopted from Zhu *et al.* (2006)

Hence, the foundation of the conceptual model is based on these three major empirical findings shows some kind of relationships in Figure 3.4. These three key recent inter-organisational system adoption studies had shown the relation of these key constructs as well as indicating the impact of the social and relational environment those firms were in.

Figure 3.4: Three Major Empirical Finding of Social and Relational Measurement



Source: Adopted from Boonstra & de Vries (2005), Lee & Lim (2005) & Zhu et al. (2006)

3.3 The Conceptual Model based on Social Exchange Theory

From the previous literature review, I would like to propose four important groups of web-based EDI adoption factor, derived from social exchange theory:

1. Technology-related (Technology Trust and e-Readiness);
2. Interest-related (Perceived Interests);
3 Social-related (Power, Dependence, and Network Effect)
4. Relational-related (Trust, Top Management Commitment, Guanxi)

Technology state refers to the concept of risk of technology that associates problems with technology security, encryption as well as the awareness of the opportunities of the technology of web-based EDI. In some cases, a lack of knowledge on how to apply available technologies inhibit companies to the adoption. Interest-related factors refer to the notion of potential web-based EDI users that perceive web-based EDI may bring some economic or strategic advantages. Social-related factors refer to situations in which potential users are able to make others to establish transactions or to situations where other users have the power to ignore web-based EDI of a business partner and the effects when the size of network grows. Relational-related factors refer to how companies trust and commit to the technology adoption as well as the extent of business relationship building towards their trading partners.

In general, social exchange theory proposes that social behaviour is the result of an

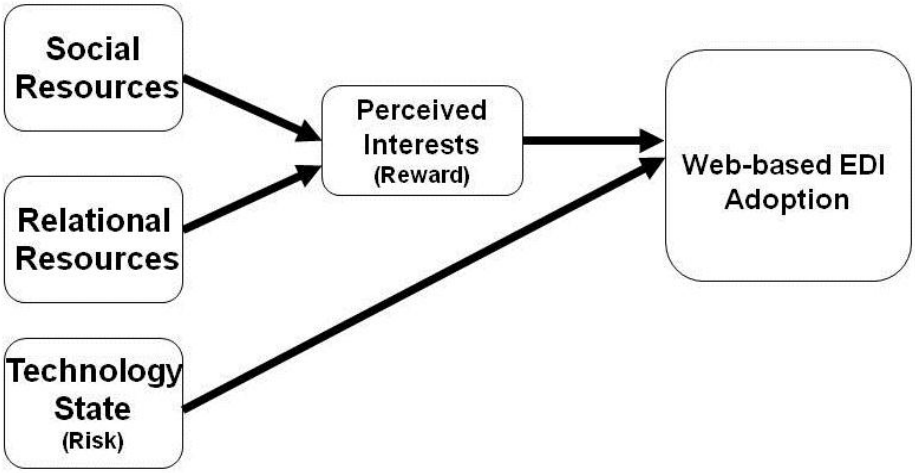
exchange process (Emerson, 1962) that resources, either tangible or intangible, are exchanged between individuals or between groups with the goal of enhancing, maintaining, or dismantling relationships or interactions. This interaction between two actors (people, firms, etc.) results in various contingencies, where the actors modify their resources to each other's expectations. In a business context, social exchange theory has been adopted to explain relationship distance/closeness in an industrial buyer-seller relationship.

According to this theory, the purpose of this exchange is to maximise expected benefits and minimise costs so that people weigh the potential benefits and risks of social relationships. When the risks outweigh the rewards, people will terminate or abandon that relationship. However, distance of two parties under exchange condition is based upon social. A key argument of social exchange theory is that interaction between the buyer and the seller is not equally effective under all conditions that in a highly uncertain and cooperative environment, relationship must reconfigure their quality to address rapid change.

Hence, from the perspective of social exchange theory, it can be argued that, actors' modification the *social* and *relational resources* can simultaneously affect others' e*xpected benefit* as a reward. Together with actors' assessment towards the risk in their current *state of technology*, when the risks outweigh the rewards, people will terminate or abandon that inter-organisational relationship via web-based EDI.

As shown in our conceptual model, which we present in Figure 3.5, we consider that both the social and relational resources are the key driver to influence the actors' perception in their expected benefits (as a reward). The reward (expected benefits or perceived interests) as well as their current technology state (risks) will then lead to adopt and use of web-based EDI adoption.

Figure 3.5: The Conceptual Model



In the next section, we propose some research hypotheses to analyse the determinants of web-based EDI adoption and use in the container shipping industry

3.4 Research Framework and Hypotheses Formulation

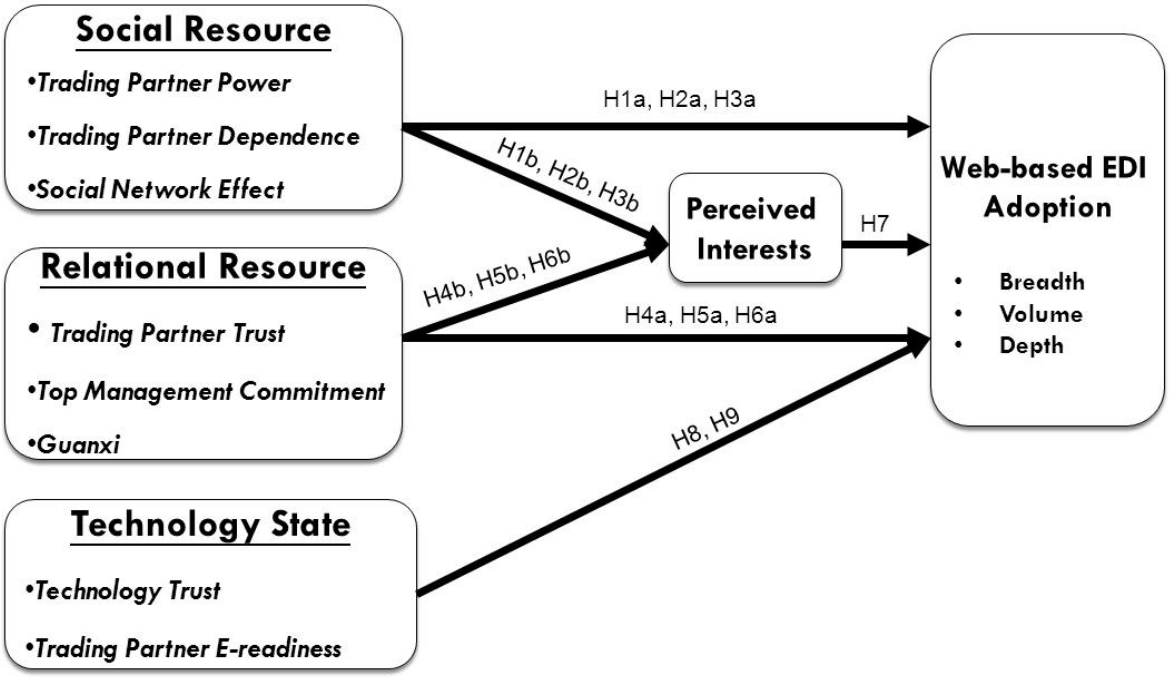
Consistent with our research purpose of studying how social and relational factors attribute to web-based EDI adoption, we specify the *extent of web-based EDI adoption* as the dependent variable measured by breadth, volume and depth.

Drawing upon the social exchange theory and the theoretical discussion above leads us to believe that the *perceived interests* from web-based EDI (i.e. the reward) are strongly influenced by both 'social resources' and 'relational resources', which have been empirically identified as a significant factor in explaining EDI adoption in other settings. Therefore, both the 'social resources' *and* 'relational resources' are posited as two independent group of variables that can lead to web-based EDI adoption both directly and indirectly, via *perceived interests*. Thus we view that the **social resources** (*trading partner power, trading partner dependence,* and *social network effect*) and the **relational resources** (t*rading partner trust, top management commitment* and *guanxi*) can simultaneously affect others' e*xpected benefit* as a 'reward'.

Hence, we identify the six social and relational resources (*trading partner power, trading partner dependence, social network effect,* t*rading partner trust, top management*

commitment and *guanxi*) to explain *perceived interests.* Together with trading partners' current state of technology, *technology state* as nine key independent variables to explain the web-based EDI adoption (see Figure 3.6). Within one unified model, these variables allow us to test how the social and relational factors attribute to the web-based EDI adoption. The variables are discussed in turn below.

Figure 3.6: Research Model



The Dependent Variable: Web-based EDI Adoption

In order to reflect the extent of web-based EDI adoption, the dependent variable is conceptualised to include three inter-related dimensions: breadth, volume, and depth (Massetti and Zmud, 1996). *Breadth* refers to the number of supply chain activities for which a firm has adopted web-based EDI (Zhu et al. 2003); *Volume* refers to the extent (percentage) to which each of the major container shipping activities has been conducted on the web-based EDI (Chatterjee *et al.* 2002); *Depth* refers to the extent to which distinct information systems are integrated by web-based EDI standards so that information can flow smoothly between back office systems within the company and between these systems with the EDI trading partners (Zhu and Kraemer, 2002).

The literature provides support for our conceptualisation. Massetti and Zmud (1996) proposed measuring EDI adoption by several inter-related facets including breadth, volume, and depth. They tested the usefulness of these dimensions via case research and found them to be a valid representation of EDI adoption. Therefore, based on the literature, it is believed that these three dimensions should not be considered in isolation. Rather, they should be viewed as mutually reinforcing elements of network applications along the value chain. Thus, the three dimensions jointly provide a coherent and comprehensive representation for web-based EDI adoption (Massetti and Zmud, 1996; Zhu *et al.*, 2006).

The Independent Variables

Below shows the nine independent variables representing as prominent factors of adopting web-based EDI in this research. These variables will be further discussed, examined in the rest of this Chapter to explain why they were selected, and then leading to the formulation of the hypotheses.

3.4.1 Trading Partner Power

According to social exchange theory, power is regarded as the most important sociological aspect of an Inter-organisational relationship when one firm needs to influence another's decision (Son *et al*., 2005). Meanwhile, resource-dependence theory emphasises the power relationships and the interdependencies between firms and other entities in the environment that influence their managerial activities in control resources needed by others and reduce their dependencies on others for resources (Pfeffer and Salancik, 1978).

Often exercised with the purpose of having an immediate influence on the other party's actions., the exercise of power is often referred to as influence strategies over actions of the other party in a dyadic exchange relationship, even if it is not actually exercised or where no attempt to influence is made. When the outputs of each organisation become inputs for one or more of the other organisations, the adoption of inter-organisational system leads to more than just relationships between organisations; For instance,

web-based EDI modifies the power structure by transferring the power from large organisations to small and mid-sized organisations (Angeles, 2000), enables smaller organisations to have a broader choice of trading partners. Thus, organisations with larger trading partner power are able to use either compulsory or convincing power over their business partners in the adoption of inter-organisational system (Chong and Ooi, 2008), such as web-based EDI. Convincing power is used to induce an organisation's partners to adopt the new technology by providing rewards and benefits, while compulsory power forces them to adopt it with the threat of abandoning the partner if it is rejected.

When an organisation has a significant bargaining power over diversified and small business partners, the compulsory power could be more effective than convincing power to force partners in adopting EDI. Firms with dominating power over their business partners—such as the ability to penalize business partners by reducing or cancelling orders—are more likely to force the use of inter-organisational systems. For instance, Wal-Mart's top 100 suppliers do not have the perceived benefits and costs about the radio frequency identification (RFID) project in 2004 and 2005. With the penalty and threat of losing Wal-Mart's business, most of these suppliers started adopting RFID. Previously, Iacovou *et al.* (1995) have suggested a firm use compulsory power to pressure business partners to comply with its policy. The more bargaining power a firm has over its business partners, the higher the likelihood the organization can obtain resources from its business partners. This disparate relationship will force companies to maintain a cooperative attitude and make them more receptive to the adoption of web-based EDI.

Therefore, the relative power status of the buyer and supplier play a crucial role in the adoption of e-business supply chain technology. In spite of the benefits which e-business endorse, many small businesses still resists for the adoption, primarily due to perceived high cost and reliance on their traditional business operation routines which developed for years (Jun *et al.*, 2000). Thus, the more powerful firms in the supply chain relationships often tend to exercise their power to force their trading partners to adopt the internet-related technologies. The statement can be supported by research of Son et al. (2008) which revealed that trading partners' power as well as the partners' transaction-specific investments made toward the relationship with a firm will positively

affect its decision to adopt e-business.

Using similar notions, Frazier and Summers (1984) describe the influence of channel partners on inter-organisational strategies and how the initiator seeks the operational and marketing benefits available through the partner's adoption of innovation. Hart and Saunders (1997) in their study of EDI adoption among office suppliers retailers found that both convincing and compulsory power were able to influence an organisation's trading partners to adopt EDI. In addition, Morris *et al*. (2003) suggest operation of EDI represent a strengthening of existing relations and further points out that the process of adopting EDI is generally not triggered by internal exigencies of efficiency and control but by an external pressures posed by larger partner organisations, so that makes individual firms to seek to develop stable ties with the organisations on which they depend.

Similarly, Boonstra and Vries (2005) found that an inter-organisational system does not depend solely on the perceived interest of users but also on the power relation between the involved parties. Explained by Standifera and Wall (2003), this is because that a powerful party with a clear interest can apply its power to urge less powerful parties to use the inter-organisational system, independent of their perceived interest in the inter-organisational system. Recently, Chong and Ooi (2008) in their study of RosettaNet standards adoption also found that electrical and electronic organisations in Malaysia were able to pressure their trading partners into adoption RosettaNet standards if they have power over their partners. Given that trading partners have shown to have influence the adoption of past inter-organisational system adoption studies, the following hypothesis is formulated:

Hypothesis 1a: *Trading partner power* is positively associated with web-based EDI adoption.

In addition, power can influence the evaluation of a business partner about the perceived benefits, thereby affecting the unwillingness to adopt EDI. For instance, Premkumar *et al*. (1995) asserted that when firms have a higher willingness to adopt inter-organisational system, they will increase their extent of adoption. This increased involvement will result

in the funnelling of increased capital and human resources to integrate internal resources, leading to a successful inter-organisational system. Based on the above literature review and the stated objectives of this study, the following hypothesis has been derived:

Hypothesis 1b: *Trading partner power* is positively associated with *perceived interests* through its effect on the web-based EDI adoption.

3.4.2 Trading Partner Dependence

According to social exchange theory, dependence is defined as the degree to which a person believes that he or she is subject to or reliant on the other for relationship outcome. The degree of dependence evidenced is determined by the degree to which the outcomes derived from a relationship exceed the outcomes perceived to be available from existing alternatives. Dependence may be experienced as one of the costs of participating in a relationship, but this is probably determined in part by the level of satisfaction experienced with the relationship. Dependence, in other words, is tolerated in highly rewarding relationships.

Dependence is further influenced by the barriers that increase the costs of dissolving an existing relationship (Levinger, 1982). Levinger (1982) proposes the existence of two types of barriers (internal and external) that discourages an individual from leaving a relationship by fostering dependence even if attraction is low. Internal barriers are the feelings of obligation and indebtedness to the partner that contribute to dependence by increasing the psychological costs of terminating the relationship. For instance, the moral belief that a marriage is forever or that children should be raised in a home with both parents present. External barriers are things like community pressures, legal pressures, and material or economic considerations that foster dependence by increasing the social and economic costs of terminating a relationship.

The resource dependency theory of Pfeffer and Salanzick (1978) is also applicable to the explanation of web-based EDI adoption. This theory asserts that inter-organisational dependence is created when one business partner “does not entirely control all of the conditions necessary for the achievement of an action or for obtaining the outcome

desired from the action" (Pfeffer and Salanzick, 1978 p.40). From this theoretical perspective, a business partner needs to reduce the degree of dependence, thereby, minimising the uncertainty of reliance on business partners for important resources. In accordance with this theory, the power structure between business partners is highly correlated with the degree of dependence and its balance, which is determined by who has the control of key resources.

The EDI implementation process requires an agreed standard, business practices, information to be shared, and the invested equipment and human resources. These requirements can substantially affect the allocation of key resources that can determine the dependency of trading partner. In fact, Web-based EDI adoption represents an attempt to manage the interdependency of organisations, creating closer and better relationships both within and between organisations (Grimaldi, 1990). As transaction-related uncertainty in the supply chain increases, trading partners will tend to intensify collaboration; hence, increase the need for information transfer and sharing between participants in the supply chain (Li and Lin, 2006). Thus, organisations that are dependent on their partners are argued to be forced to participate in electronic partnerships, even if this increases vulnerability.

According to the social exchange theory, the exchange framework also provides insight into the dynamics found within intimate relationships. In particular, the exchange framework has been used to explain the patterns of power and decision-making found within relationships. Fundamental to the exchange views of power are the assumptions that dependence and power are inversely related, and resources and power are positively and linearly related (Thibaut and Kelley, 1959; Houston, 1987). This is to suggest that exchange theorists address the bases of power by focusing on the constructs of dependence as a resource.

The partners least interested in their relationships tend to have the greater power in large part because they are less dependent on the relationships. The partners with the greater resources, also, tend to be the ones with the greater power—here largely because they have relatively greater control over the outcomes available to the partners. In other words,

the essential point of the discussion of patterns of interaction observed within exchange relationships is that the relative levels of involvement, dependence, and resources contribute importantly to different patterns of interaction observed within relationships.

Despite organisations acknowledge the benefits from greater sharing of information with trading partners; they often fear that electronic linkages would potentially result in loss of control of their business operations by opportunistic behaviour of their trading partners. Previously, Emerson (1962) viewed dependency as the greatest source of power, postulating that if party A is highly dependent on party B, B became more powerful. As stated by Jun *et al.* (2000, p 413), in a typical buyer-supplier relationship, there will be a certain degree of inherent dependency between the two trading partners: For example, a supplier that provides scarce resources or access to these resources has the power to exert significant control over inter-organisational transactions (Jun *et al*. 2000, p. 413).

Research on supply chain management has identified trading partner dependence as an important factor in the formation of supply-chain partnerships (Lee and Lim, 2005). Hart and Saunders (1997) argued that EDI introduces an element of complexity into relationships because coordination through EDI is dependent on the willingness of two (or more) firms to invest in the computer systems to reach the mutual goals and EDI allows the internal activities of an organisation to become more transparent to external parties; EDI partners may use this more readily accessible information in ways that a firm is not able to control. This new uncertainly arise leads to an increase in trading partner dependence. Similarly, Lee and Lim (2005) argued that when firms entering into an inter-organisational partnership, all partners acknowledge a high level of mutual dependence because the formation of inter-organisational relationship (via EDI) is motivated to achieve goals that each firm, acting alone, could not attain easily. Thus, this electronic linkage to information introduces a new source of trading partner dependence and vulnerability into an inter-organisational relationship.

Hence, trading partner dependence play an important role in influencing firms' decision to adopt inter-organisational web-based EDI systems. Organisations at the strongest position in the supply chain generally provide the driving force in adopting EDI, which

facilitates the building of linkages, making for certainty in exchanges, and ultimately enhancing the dependency of 'junior partners' on the core firm.

In the context of container liner shipping industry, there is a pooled-dependency relationship with their EDI trading partners as the container liners may share resources such as transportation vehicles or storage operation in different geographic locations. In this case, the exchange of information between the supply partners would be limited to what is operationally necessary. Secondly, there is a sequential-dependency relationship with their EDI trading partners; that is, units work in series where the output from one unit becomes input to another unit. For example, one container liner may co-operate to carry another liner's container by entering as strategic alliances. In order to achieve smooth operations, the alliance members need to exchange information on order booking, storage allocation, delivery schedules and payments more frequently.

Finally, there is a reciprocal-dependency relationship with their EDI trading partners; that is, each receives input from and provides output to the other, often interactively. For example, the shipper's container of loading port will require high levels of coordination between supply partners (i.e. through forwarding companies, shipping liners, tracking companies, stevedore, other shipping liners and the destination tracking companies, warehousing, and so on). They need to exchange information across multiple stages. Hence we propose that:

Hypothesis 2a: *Trading partner dependence* is positively associated with web-based EDI adoption.

Furthermore, as previously mentioned in social exchange theory, *trading partner dependence* can be viewed as a Relational Resource, which can have a positive impact towards the Social Exchange Reward (*perceived interests*). Hence, the following hypothesis has been derived:

Hypothesis 2b: ***Trading partner dependence* is positively associated with *perceived interests* through its effect on the web-based EDI adoption.**

3.4.3 Social Network Effect

Since the adoption of web-based EDI requires co-ordination between at least two organisations, the social and inter-organisational relationships between the organisation and its prospective trading partner(s) becomes the most obvious. In the best-case scenario, both firms agree that adoption is in their mutual best interest, web-based EDI became an example of a technology with positive externalities or network effects; thus, actions of one firm will depend on (its perception of) the collective actions of other firms.

Collective actions and technology have been studied within a number of disciplines; Bouchard (1993) labels this collected work "critical mass theory." However, the positive benefits of having a critical mass of firms adopting the same technology is only one aspect of inter-organisational relationships and web-based EDI adoption; another significant factor is its social power, such as when one organisation encourages or coerces its EDI trading partners to adopt. In the context of web-based EDI adoption, we characterise factors relating to the social actions of other organisations as social network effect.

In the presence of positive network externalities (Katz and Shapiro 1985), the value of an open-standard inter-organisational system (such as web-based EDI) increases with its size, and thus as the size of the network rows, firms will have stronger incentives to adopt it. Therefore, we propose social network effects as a driver for the adoption of web-based EDI. Furthermore, we look at factors that contribute to social network effects. In doing so, it is reasonable to consider how the size of an open-standard inter-organisational system might grow. According to Zhu *et al.* (2006), there are two types of firms joined to the size of an open-standard inter-organisational system network—vertical partners (that is, either upstream or downstream) in the trading community, and horizontal peers at the same level in the supply chain (Teo *et al.,* 2003). Thus, the social network effects will increase as more trading partners and peers support and adopt the open-standard inter-organisational system.

Motivated by Zhu *et al*. (2006), network effect, measures the trading community influence as the extent to which a firm's customers, suppliers, and other vertical partners

in its trading community are willing to use or support the web-based EDI system. In addition, network effects measures the peer adoption as the extent of web-based EDI adoption among horizontal peers in the same industry. These two variables, based on the above theoretical considerations, are then specified as forming a second-order construct; we called it - *social network effects*, so as to represent the construct as a social resource. Since trading community influence and peer adoption correspond to direct and indirect network effects – the two major aspects of network effects identified in the literature – our specification is consistent with the network effects literature (Farrell and Saloner 1985; Katz and Shapiro 1985).

Since developing web-based EDI requires joint efforts across firm boundaries, and the benefits of adopting it thus contingent on the status of network adoption by other firms. Therefore new variables reflecting the adoption status in a wide range of trading partners are needed to address the nature of open-standard inter-organisation system (Zhu *et al.*, 2006). Consequently, the increase of scope of network effects is likely to encourage the adoption of web-based EDI. Hence, we present hypotheses on how social network effect affects phases of innovation adoption in the web-based EDI and the perceived interests.

Hypothesis 3a: *Social network effect* is positively associated with web-based EDI adoption.

Furthermore, as previously mentioned in social exchange theory, *social network effect* , the Relational Resource can have a positive impact towards the Social Exchange Reward (*perceived interests*).These relationships have been proposed or implied by theoretical research on network externalities (Farrell and Saloner, 1985), though they have not been tested empirically (Kauffman *et al.*, 2000). In particular, Zhu *et al.* (2006) have explicitly tested how network effects influence expected benefits, as most existing studies have proposed a direct linkage between network effects and adoption without measuring *perceived interests*. Hence, we would like to propose the following hypothesis.

Hypothesis 3b: *Social network effect* is positively associated with *perceived interests* through its effect on the web-based EDI adoption.

3.4.4 Trading Partner Trust

The literature on trust supports the contribution of trust to the inter-organisational relation. The belief that a party will perform its obligation in the relation enables successful management of stress and dispute. The trust is highly associated with the desires of firms to collaborate (Pruitt, 1981) and the trust lowers stress and improves the adaptability (Williamson, 1975). The information exchange is facilitated and the effectiveness of joint problem solving is also improved by trust (Zand, 1972). Once the trust is established, the joint efforts often result in better outcomes than that resulting from the efforts of one firm alone (Anderson and Narus, 1990).

In the context of supply chain management, trust between trading partners is a key facilitator of inter-firm relationships for the success of business affiliation. Trust on inter-organisational relationships demands for an optimistic expectation of positive future behaviour and is comprised of numbers of element such as integrity, competence, fairness, loyalty and openness and frankness between trading partners (Icasati-Johanson and Fleck, 2003). When business partners propose adopting web-based EDI to facilitate their transactions, an organisation trusting its EDI trading partners is more likely to reach consensus in terms of the achievable benefits.

An organisation may also think it is worthwhile to invest in the adoption due to its trusting partners. Nidumolu (1989) found the trust in business partners could encourage the willingness of an organisation to open for negotiation and share information. Like any inter-organisational system, trust is also an important factor for the success of EDI. Trusting organisations are more willing to invest in EDI and share information with their business partners. Moreover, trust can stop opportunist behaviour from appearing. The opportunity to share information with business partners will improve after the reduction of the opportunists' behaviour. Hart and Saunders (1997) asserted that once an organisation adopted EDI, it would decide to extend the use of EDI based on the degree of trust between business partners.

At organisational level, a positive relationship between trust and cooperative

relationships have been well documented in various branches of organisation studies. Looking specifically at antecedents of cooperation, Smith *et al*. (1995) have noted that trust is a fundamentally important factor predicting the level of intra and inter-organisational cooperation. Previously, in Dirks and Ferrin's (2001) review of the literature on the role of trust in organisational settings, they demonstrates that trust has either direct or moderating effects on a variety of behavioural outcome variables because trust provides conditions under which certain outcomes are more likely to occur. For instance, high trust ensures that the EDI trading partners do not violate the agreement and reduces the vulnerability of the system as the number of partners increase. This is especially important for web-based EDI system. The sender of transactions has to rely on the recipient to have sufficient integrity and security controls in place to guarantee that transmission is not altered once received.

In the context of EDI adoption, Ratnasingam (2001) studied the influence of trust in EDI adoption between an automobile manufacturer and their supplier. The term 'soft trust' was used to refer to the trust in the trading partner relationship. The result from the study showed that trust is important for cooperative long-term trading relationships. Lee and Lim (2005) in their study of partnership attributes' impact on EDI implementation, they found that trust among trading partners will affect the extent to which companies undertake EDI integration and increase the percentage of EDI exchange and performance. Similarly, Chong and Ooi (2008) in their study of RosettaNet standards adoption, they also found that trust is one of the important factors in influencing trading partners to adopt the technology. The result from the study showed that relationships between the supply chain partners need to be established before the adoption of RosettaNet standards can take place. Organisations that have adopted the technology also believe that they will work long term with the partner.

In general, trust is a firm's belief that another company will perform actions that will result in positive outcomes from the firm, as well as not take unexpected actions that would result in negative outcomes for the firm. Among trading partners, trust is defined as the subjective probability with which organisations assess that another organisation will perform potential transactions according to their confident expectations (Monczka *et*

al., 1998). It is suggested that trust is conveyed through faith, reliance, belief, or confidence in the supply chain partner, viewed as a willingness to forego opportunistic behaviour or view as one party's confidence in the reliability and integrity of an exchange partner (Spekman *et al.*, 1998). Overall, the finding from literature in trust confirmed in other studies found that organisations are more likely to engage in internet-based exchanges with trusted parties (Vlosky *et al.*, 2000). Building mutual trust with other organisations should, therefore, be given attention in the development of web-based EDI linkages between business partners. Hence, the following hypothesis has been derived:

Hypothesis 4a: *Trading partner trust* is positively associated with web-based EDI adoption.

Despite of the diversity in trust theories, a common set of components appears in several theories. First, there must be some motivation for one party to trust another. The fact that one party has a need which can potentially be met by the other implies a degree of vulnerability as trustor is placing themselves at some risk towards the potential more powerful party. As trustor relies on the trusted, or trustee, to share their commitment towards a common goal, some confidence in the past and reliability of the trusted party to access whether they are likely to fulfil either part of the bargain needs to be felt. The boundaries of trust are reached when one party perceives that the risks in trusting the other party outweigh the perceived interests (Sutcliffe, 2006).

Given the uncertain nature of the online environment in the web-based EDI adoption, we argue that trading partner trust is important for web-based EDI adoption. Drawing from the literature on security services in e-commerce (Palmer *et al*., 2000; Lee and Turban, 2001), they proposed the linkage between trust and perceived interests are popular among scholars who have studied trust in organisations using e-commerce technologies (Ratnasingam *et al.*, 2002). Hence, we propose that the effect from the *trading partner trust* will be positively correlated to the *perceived interests* of its trading partners. Hence, the following hypothesis has been derived:

Hypothesis 4b: *Trading partner trust* is positively associated with *perceived interests* through its effect on the web-based EDI adoption.

3.4.5 Top Management Commitment

Maintaining a cooperative partnership requires a strong commitment (Lee and Lim, 2005). Coordinated actions based on partner's commitment should be exerted to attain mutual objectives in successful working relationships (Anderson and Narus, 1990). The confidence that the affiliation will endure is central to the committed relationships. The commitment from partner is necessary in making users become familiar with the technology and the changing inter-organisational work processes (Lee and Lim, 2005). The establishment of procedures and adjustments in inter-organisational process details with trading partners significantly requires committed partner efforts (Premkumar *et al.*, 1994).

Commitment has been characterised as central in distinguishing social and intimate exchanges from economic exchanges by Cook and Emerson (1978). Commitment involves the willingness of individuals to work for the continuation of their relationships (Scanzoni, 1979). Exchange theorists would expect commitment to develop within a relationship when partners experience high and reciprocal levels of rewards that facilitate the experience of trust (Sabatelli, 1999). Commitment can also build the stability into a relationship by increasing partners' dependence on their relationships. Commitment, therefore, represents a duty or obligation to engage in future action and arises from frequent interaction (Coleman, 1990). Commitment, also, is a long-lasting desire to maintain a valued relationship, incorporating each party's intention and expectation of continuity of the relationship, and willingness to invest resources in the supply chain (Mentzer *et al.*, 2000) and discriminates between relationships that continue and that break down (Wilson and Vlosky, 1998).

In general, an innovation is commonly adopted when top managers decide to go ahead with new idea and allocate resources to it (Damanpour and Schneider, 2006). Among some other types of organisational commitment, the commitment from top management plays a critical role in shaping organisation's value and orientation. Numerous studies have found it critical in creating a supportive climate and providing sufficient resources (Chatterjee *et al*., 2002). For instance, Damanpour and Schneider (2006) point out those top managers affect innovation adoption because they modulate the process of scanning

the environment, formulating policy to respond to environment change, and controlling resources and influencing major decisions. Similarly, study of Mentzer *et al*.(2000) also shown the importance of top management commitment in facilitating the information sharing in supply chain so that able to embrace the significant operational and market impacts of partnering and develop a good understanding of their potential partners and their top management.

Since top management recognises strategic opportunities and provides long-term vision, attributes that are critical for successful adoption of an innovation. The importance of top management commitment for successful adoption of innovation is well documented in empirical studies (Ngai *et al*, 2004; Lee and Lim, 2005; Li and Lin, 2006). Also, top management commitment has been consistently found to be critical in the context of EDI (Premkumar *et al*., 1994).

Therefore, to a large degree, that commitment for the top management appears to make it more difficult for partners to act in ways that might adversely affect overall supply chain performance. Hence, we present hypotheses on top management commitment is positively associated with the web-based EDI adoption.

Hypothesis 5a: *Top Management Commitment* is positively associated with web-based EDI adoption.

As previously mentioned earlier in this chapter, based on the social exchange theory, *top management commitment* can be viewed as a Relational Resource, which can have a positive impact towards the Social Exchange Reward (*perceived interests*). Hence, the following hypothesis has been derived:

Hypothesis 5b: *Top Management Commitment* is positively associated with *perceived interests* through its effect on the web-based EDI adoption.

3.4.6 Guanxi

The term 'Guanxi' has appeared in both popular and academic literature, and has been investigated in widely different contexts, including culture, ethics, psychology, demography, sociology and economics. Park and Luo (2001) argue that Guanxi is a complicated and pervasive relational network consisting of mutual obligations, assurances and understandings. Walder (1986) strengthened that "in sociological terms, Guanxi consists of personal ties or social bonds". Tsang (1998) took Guanxi as "the informal connections", King (1991) considered that the Chinese concept of Guanxi is a form of social network, and Jacobs (1980) defined "Guanxi as the existence of direct particularistic ties between two or more individuals". From these definitions, it is difficult to distinguish between Guanxi and individual relationship, the common sense is that Guanxi is an interpersonal relationship or social connections (Chen and Chen, 2004), Guanxi is posed by an individual and works at the level of the individual (Wang, 2007).

Some authors (Ambler *et al.* 2000, Wong and Chan, 1999) have suggested that Guanxi marketing represents a traditional form of relationship marketing. Even Zhuang (2003) argued that relationship marketing philosophy is derived from the Chinese culture. Wang (2007) contends that western relationship marketing and Guanxi share some basic characteristics such as mutual understanding, cooperative behaviour and long-term orientation. Sabine (2005) called for broader observation and careful consideration about traditional paradigms of Chinese Guanxi to develop relationship marketing paradigms. This study attempts to fill this gap by applying the concept of Guanxi into the web-based EDI context through social exchange theory.

Social exchange is a condition in which the actions of one party provide the rewards and incentives for the actions of another party and vice versa in repeated interactions (Homans, 1958; Blau, 1964). A mere onetime exchange in the marketplace, where a buyer is able to choose a seller depending on the price offered by the seller, is not considered a social relationship. But, if there are repeated interactions between the buyer and the supplier, the relationship grows and develops as a consequence of an unfolding social exchange and coordination process, which may be conceived as a bartering of rewards and costs between the partners (Ring and Van de Ven, 1994). The importance of social

exchanges in various business and economic transactions has been underscored by various socio-economic perspectives. From the viewpoint of social exchange theory, the inter-firm exchange and coordination processes should enhance relational ties and promote norms of fair exchange (Dyer and Singh, 1998). Benefits are likely to be greater for both parties if there is reciprocity (mutual commitment), trust, and some give-and-take between them.

Since within the social exchange relationships are governed by both normative and cognitive exchange orientations that define acceptable and appropriate behaviour in relationships, these norms refer to the broader consensus that exists within a culture about how exchange relationships should be structured. Whereas cognitive orientations represent the beliefs, values, and relationship orientations that an individual associates with various types of exchange relationships (McDonald, 1981). These orientations serve as the standards for interpersonal behaviour that an individual brings to his or her personal relationships. Therefore, Guanxi is an interpersonal relationship or social connections (Jacobs, 1980; Zhuang, 2003; Chen and Chen, 2004); Guanxi is posed by an individual and works at the level of the individual (Tsang 1998). To some extent, it can be argued that Guanxi is a special social exchange concept used to establish good and believable individual relationship through the reciprocal favour exchanging relationship. Many authors (Zhuang, 2003; Wang, 2007) argued that Guanxi marketing represents a traditional form of relationship marketing.

In simple term, Guanxi literally means relationship or connection. It can be translated as friendship with implications of continued exchange of favours (Pye, 1992). For the purpose of this study, Guanxi is referred as an establishment, development and maintaining long-term business relationship and it embodies reciprocal obligations and is based on relationships rather than objectivity. Therefore, since web-based EDI adoption is a process in which two or more organisations determine how to work together along their value-chain activities via Internet, the more of the reciprocal obligations based on social connection or long-term business relationship is thus more likely to increase the organisation's willingness to adopt inter-organisational system (such as, web-based EDI). Although Guanxi has not yet been identified as a factor for web-based EDI adoption,

based on the social exchange theory in this study, I would like to argue that relational exchanges through reciprocal favour exchanging via Guanxi plat a positive role in the web-based EDI adoption. Hence, the hypothesis 6a.

Hypothesis 6a: *Guanxi* is positively associated with web-based EDI adoption.

Furthermore, as previously mentioned in social exchange theory, *Guanxi* can also be viewed as a Relational Resource, which can have a positive impact towards the Social Exchange Reward (*perceived interests*). Hence, the following hypothesis has been derived:

Hypothesis 6b: ***Guanxi* is positively associated with *perceived interests* through its effect on the web-based EDI adoption.**

3.4.7 Perceived Interests

According to Cragg and King (1993), perceived interest of EDI is the only variable that has been consistently identified as one of the most critical adoption factors for information technology growth in small firms. Perceived interests can be referred to the anticipated advantages that inter-organisational system brings to adopting firms. The literature supports the impacts of perceived interests on EDI adoption (Iacovou *et al.*, 1995; Ramamurthy *et al*., 1999; Chwelos *et al*., 2001).

Many practitioners and researchers have attempted to identify the potential advantages that EDI technology has to offer. Pfeiffer (1992) grouped them into two categories – direct benefits and indirect benefits. Direct benefits include expected operational efficiencies such as reduced transaction costs, improved cash flow, reduced inventory levels, and higher information quality. Indirect benefits refer to opportunities to change business processes and relationships with trading partners. They include increased operational efficiency, better customer service, improved trading partner relationships, and increased ability to compete.

Organisations nowadays have to deal with various perceptions and beliefs about engaging in electronic exchanges of their current and prospective business partners. These

concerns can range from impersonalisation of business relationships to loss control, ownership and flexibility, including risk of partners losing interest and motivation due to perception of inequity, for instance, feeling unfairly treated or being under rewarded in the relationship. Therefore, we consider a firm's perceived interests to be an important decision factor in explaining web-based EDI adoption, which is motivated by innovation diffusion theory in which perceived benefits are an important driver of new technology adoption (Rogers, 1995).

The Internet has been widely accepted as a technology for efficient information processing, which helps firms improve operational efficiency and reduce transaction costs, search costs, and other direct and indirect costs (Zhu and Kraemer, 2002). Previously, firms using traditional EDI were only capable of exchanging information with known partners with established business relationships. Now, by using open standards of web-based EDI, firms are able to search for and cost-effectively connect to other firms that also support open standards, facilitating expansion into new markets and reaching new customers (Phillips and Meeker, 2000). In addition, web-based EDI makes it easier for suppliers and trading partners to exchange data on inventory, delivery, and production schedules, thus improving value chain coordination (Zhu and Kraemer, 2005).

Therefore, perceived interests, by our definition, go beyond the stand-alone benefits of a technology, since benefits derived via value chain coordination, market expansion, and cost reduction will be greater as network increase (Iacovou *et al.* 1995). Therefore, we expect strong associations between *perceived interests*, and web-based EDI adoption. Hence, the following hypothesis is derived.

Hypotheses 7: *Perceived interests* is positively associated with web-based EDI adoption.

3.4.8 Technology Trust

Trust in Internet-based Business-to-Business e-commerce is an important issue for both practitioners and academicians. Whereas the traditional notion of dyadic inter-firm trust primarily focuses on trust in a trading partner firm, trust in e-commerce also implicitly incorporates the notion of trust in the transaction infrastructure and underlying control mechanisms (technology trust), which deals with transaction integrity, authentication, confidentiality, non-repudiation, and best business practices. In a highly uncertain environment with changing markets, organisations tend to build some strategic partnerships with their supply chain member to share information, to increase organisational flexibility and to reduce risk associated with the uncertainty.

However, the technology development provides not only opportunities, but also treats, for individual organisations (Li and Lin, 2006). The easy access of Internet and the development towards open standard information system (Zhu *et al.* 2006) increases the competition base , the security risk of Internet or web-based communication have influenced the adopters' trust perception in technology. This research explicitly examines this institutional character of trust in web-based EDI context, arguing that business value realisation is heavily dependent on the dimension of technology trust, captured as perceived benefits

The grounds on why organisations are moving towards information systems, such as web-based EDI, are because they see optimistic results. Josang *et al.* (2005) argue that individuals are willing to trust information systems, as they trust other humans, knowing that there are potential risks. Once they trust, if they have a good experience, then trust is gained, hence the fabrication of trust, building reputation, which proves beneficial for potential users. On the other hand, if the individuals have a bad experience, then there is no trust for the future, causing a bad reputation for a particular information system. Therefore, it is important that their technology trust is gradually developed through adopters' perception in adopting the new technology. Sutcliffe (2006) mentions that 'technology acting as a mediator of trust between people, organisations or products.' In essence, Sutcliffe means that the uncertainty that is present in relationships can be either

reduced or increased by how the user perceive their trust in technology.

Finally, following the notion of institutional trust (McKnight *et al*., 1998), technology trust is defined as "the subjective probability by which organisations believe that the underlying technology infrastructure is capable of facilitating transactions according to their confident expectation" (Ratnasingam and Pavlou, 2003, p22), which can be also viewed as an instance of situational normality in the sense that the underlying technology infrastructure facilitates normal transactions according to the organisation's confident expectations (Ratnasingam *et al*., 2002).

Drawing upon the rich trust literature and recent conceptualisations for the role of in e-commerce, it is hypothesised that *technological trust* is positively associated with the web-based EDI adoption (See below). This view is consistent with other researchers who proposed institutional-based trust (McKnight *et al*., 1998).

Hypotheses 8: *Technology trust* is positively associated with web-based EDI adoption.

3.4.9 Trading Partner e-Readiness

In the context of inter-organisational systems, however, readiness is not solely restricted within an organisation-level construct. At minimum, adoption of inter-organisational system requires readiness on the part of two trading partners. Previously, Ferguson (1992) measures the willingness and ability of potential partners to adopt EDI. Chwelos *et al*. (2001) have augmented the readiness construct labelled *trading partner readiness* to consider a firm that may be motivated to adopt EDI and be ready to adopt (i.e., having available financial resources and IT know-how).

Trading partner readiness is an important factor because the value of e-business can be maximised only when many trading partners are using it (Iacovou *et al*., 1995). As suggested by empirical evidence, the success of e-business depends on the trading partners' readiness to jointly use the internet to perform value chain activities (Barua *et al.*, 2004). In a trading community with greater partner readiness, individual adopters reveal higher levels of e-business usage due to network effects (Shapiro and Varian, 1999).

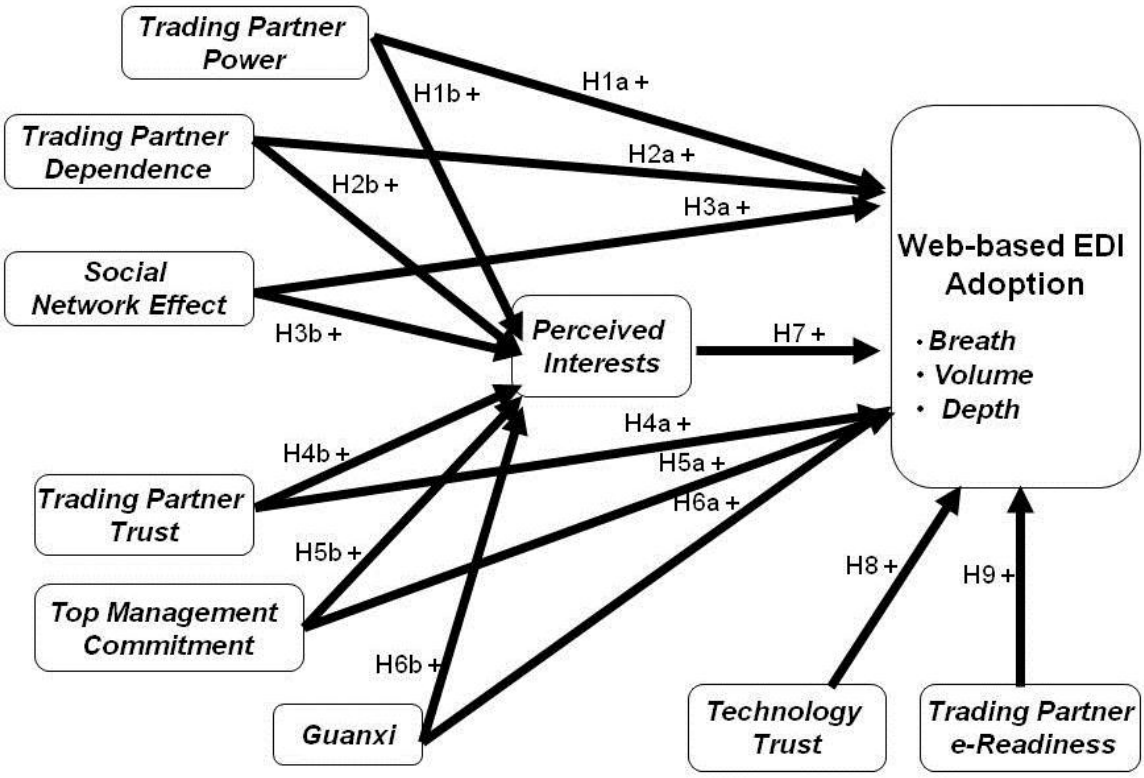
Some empirical researches suggest that trading partner is an important determinant for EDI and e-business adoption and use (Iacovou *et al*., 1995; Zhu *et al*., 2006; Lin and Lin, 2008). For instance, Chwelos *et al*. (2001) augmented the Iacovou *et al*. (1995) model with the additional construct of "trading partner readiness" (which includes the trading partner's IT sophistication and willingness to change, as well as the adopting company's trust in the trading partner and the adequacy of legal and financial controls).

In this study, we labelled as *Trading Partner eReadiness*, referring to the degree of expertise and experience in place at the target firm at the time of the particular web-based EDI project being examined. As a firm links up electronically with more and more of its trading partners it develops the experiences and know-how to make further adoption somewhat easier. A high degree of target's e-readiness can enable a target firm to adopt web-based EDI successfully. Conversely, low trading partner eReadiness might mean the adoption of web-based EDI is doomed to failure due to trading partner's less expertise and experience in web-based EDI. Thus, we expect that:

Hypotheses 9: *Trading Partner e-Readiness* is positively associated with web-based EDI adoption.

Therefore, based on the previous literature on social exchange theory and the discussion above, the overall research model and hypotheses is shown in Figure 3.7 below.

Figure 3.7: Research Model and Hypotheses



Chapter 4

Methodology

Chapter Four begins with a discussion on research philosophies regarding to different paradigms and matter of ontology and epistemology. Outline the chosen methodological approach for data collection, starting from the process of developing and administrating of the questionnaire in the pilot study (Case Study 1) to the methods employed during the analysis of data in Case Study 2 and Case Study 3 and explains approaches of gathering valid and reliable samples in measuring those key constructs. It also shows the items of each constructs were modified and refined based on the result and the implication derived from the Case Study 1 and Case Study 2. Finally, shows areas of non-response bias control as well as ethical consideration of the research.

4.1 Research Philosophies

When undertaking research of this nature, it is important to consider different research paradigm and matter of ontology and epistemology. Since these parameters describe perceptions, beliefs, assumptions and the nature of reality and truth (knowledge of that reality) (Easterby-Smith *et al*., 2008). They can significantly influence the way in which the research is undertaken from its design through to conclusions. Therefore, it is important to understand and discuss these aspects in order that approaches congruent to the nature and aims of the particular inquiry is adopted, and to ensure that researcher biases are understood, exposed, and minimised. These aspects are highly relevant to Social Science since the humanistic element introduces a component of 'free will' that adds a complexity beyond that seen in the natural sciences and others (Blaikie, 1993).

Blaikie (1993) describes the root definition of ontology as 'the science or study of being' and develops this description for the social sciences to encompass 'claims about what exists, what it looks like, what units make it up and how these units interact with each other'. In short, ontology describes our view (whether claims or assumptions) on the nature of reality, and specifically, is this an objective reality that really exists, or only a

subjective reality, created in our minds. As a result, we all have a number of deeply embedded ontological assumptions, which will affect our view on what is real and whether we attribute existence to one set of things over another. If these underlying assumptions are not identified or considered, the researcher may be blinded to certain aspects of the inquiry or certain phenomena, since they are implicitly assumed, taken for granted and therefore not opened to question, consideration or discussion. When considering that different views exist regarding what constitutes reality, another question must be how is that reality measured, and what constitutes knowledge of that reality. This leads us to questions of Epistemology.

Epistemology considers views about the most appropriate ways of enquiring into the nature of the world (Easterby-Smith *et al*., 2008) and 'what is knowledge and what are the sources and limits of knowledge' (Eriksson and Kovalainen, 2008). The position of the researcher's epistemology defines how knowledge can be produced and argued for. This heavily relates to the research method tone chose to rather the related data source. In considering this link, the need to understand the position of the researcher becomes more obvious. If the researcher holds certain ontological positions or assumptions, these may influence the epistemological choices or conclusions drawn.

These discussions lead us to the next area for consideration - research philosophy/ paradigm. These philosophies are formed from basic ontological and the related epistemological positions, and have developed in both classical and contemporary forms to effectively classify different research approaches. The key classical paradigms that will be discussed below are those of Positivism and Social Constructivism.

Positivism is grounded in a research philosophy that asserts that *"Social world exists externally, and that its properties should be measured through objectives methods, rather than being inferred subjectively through sensations, reflection or intuition"* (Easterby-Smith *et al*. 2002, p 28). For this reason, a positivist philosophy has a number of key characteristics in that the *"Positivist epistemology limits its conception of valid or warranted knowledge to what is to taken to be unproblematically observable 'sense data'. If theory corresponds with a researcher's observations of these facts its truthfulness is*

taken to be established. If it fails to correspond, it is discarded as fallacious" Gill and Johnson (1997, p139). In other words, the positivist position is derived from that of natural science and is characterised by the testing of hypothesis developed from existing theory (hence deductive or theory testing) through measurement of observable social realities. This position presumes the social world exists objectively and externally, that knowledge is valid only if it is based on observations of this external reality and that universal or general laws exist or that theoretical models can be developed that are generalisable, can explain cause and effect relationships, and which lend themselves to predicting outcomes.

However, the Positivist position has been thoroughly criticised over the years in terms of both its illusive feasibility and desirability. According to Fagan (2012) Max Horkheimer has previously criticised the classic formulation of positivism on two grounds. The first criticism argued that positivism systematically failed to appreciate the extent to which the so-called social facts it yielded did not exist 'out there', in the objective world, but were themselves a product of socially and historically mediated human consciousness. Positivism ignored the role of the 'observer' in the constitution of social reality and thereby failed to consider the historical and social conditions affecting the representation of social ideas (Fagan, 2012). Secondly, he argued, representation of social reality produced by positivism was inherently and artificially conservative, helping to support the status quo, rather than challenging it (Fagan, 2012).

On the other hand, by adopting a more social constructionism stance, one can potentially dig deeper to explore the taken for granted assumptions of the social world (Smith, 1998). As Easterby-Smith *et al.* (2002) argue, the world and reality are not objective and exterior but are socially constructed and given meaning by people. Social constructionism is concerned with the meanings that research actors attach to social phenomena. Unlike positivism, phenomenology argues that the world is not objective and external but is in fact subjective and socially constructed; the observer is not independent; and that science is not value free (Easterby-Smith *et al.*, 2002). As Easterby-Smith *et al.* (2002) argue, the world and reality are not objective and exterior but are socially constructed and given meaning by people. Social constructionism is therefore concerned with the interpretive

meanings that research actors attach to social phenomena. Unlike positivism, social constructionism argues that the world is not objective and external but is in fact subjective and socially constructed; the observer is not independent; and that science is not value free (Easterby-Smith *et al.*, 2002).

However, social constructivism focuses on the individual interpretation of a perceived external reality, and it has been claimed that "individual understanding and conceptualisation is parasitic upon this extra-individual scientific domain", leading to the criticism that social constructivism is "old unpalatable, empiricist wine in a new bottle" (Matthews, 1992). One of the most tangible criticisms of social constructivism is the type of learning it supports. While it may be true that social negotiation is a useful approach to achieving consensual understanding of ill-structured subject matter, even in the 'softest' subjects there is often a body of undisputed knowledge. Social constructivist strategies are often not efficient, resulting in "a trial-and-error approach to the performance in the real world" (Merrill, 1997). Overall, Table 4.1 provides a summary of the main features of both positivism and social constructionism.

Table 4.1: Comparison of Positivism and Social Constructionism

Area	Positivism	Social Constructionism
Perception of the World	The social world is separated from human beings. Social reality can be investigated by the use of objective measures.	Humans are part of the social world, which exists due to the interaction and actions of human beings.
Objectives	Empirical testing of theories by process of verification or falsification for reaching a general principle.	The understanding of how members of a social group by actions enact meanings, beliefs and realities of the social world.
Research Methods	Hypothetical deductive approach.	Process of understanding how practices and meanings are formed by humans as they work towards common goals.
Methods of Data Collection	Sample surveys and questionnaires.	Interviews, documents and observations.
Methods of Analysis	Statistical models.	Interpretation, description and analysis of the social world from the viewpoints of the participants.

Role of Respondents	Information based on frameworks prepared by researcher through questionnaires.	Allow respondents to use their own ways of explaining their experiences and concepts of the social world.

Source: Adapted from Silverman (1993)

Prior this study, most of the research efforts have addressed and examined the EDI adoption decision from the positivist stand. Grover (1993), taking a comprehensive approach, empirically identified five factors that statistically discriminated between organisations that have and have not adopted EDI. Iacovou *et al.* (1995) studied EDI adoption decisions in small businesses. Premkumar and Ramamurthy (1995) examined the inter-organisational and organisational factors that influence the decision mode for adoption of EDI. Hart and Saunders (1997) developed a theoretical framework to address the roles that power and trust play in EDI adoption and use. Premkumar *et al*. (1997) developed a comprehensive research model that identified 11 factors under three broad categories (environmental, organisational, and innovation characters) that could potentially influence the adoption of EDI in trucking industry. More recently, Chwelos *et al.* (2001) developed model of EDI adoption that incorporates constructs that comprehensively address the technological, organisational, and inter-organisational levels. Lee and Lim (2005) developed a research model that identified partnership attributes that affect EDI implementation.

In today's digital economy, despite more and more firms are turning to more flexible cost-effective web-based approaches that capitalise on many-to-many relationships (Elgarah *et al*., 2005), the research is still in its infancy in exploiting the implications Narayanan, 2009). The emergence of web-based EDI has caused a shift in the conceptualisation of EDI as an electronic dyad integrating a single buyer and supplier, to a system that supports a single firm's linkages with a large number of supply chain partners (Narayanan, 2009). Few research studies were found that focus on business adoption and use of the web-based EDI. Vadapalli and Ramamurthy (1998) studied the factors that influence adoption and use of the Internet in general. Teo *et al*. (1998) continued the efforts to identify factors influencing decisions to adopt the Internet in the workplace. They found that trust among trading partners will affect the extent to which companies

undertake EDI integration and increase the percentage of EDI exchange and performance. Huang *et al*. (2008) developed a comprehensive framework that helps explain organisations' adoption of Internet EDI technology.

Our study focus, particularly, on the social and relational factors influencing the adoption decision derived from the closely related literature in areas such as container liner industry, and the adoption of web-based EDI. In addition, there have been concerns about several social and relational factors when adopting web-based EDI. Trading Partner Power, Trading Partner Dependence, Social Network Effect, Trading Partner Trust, Top Management Commitment, Guanxi, Perceived Interests, Technology Trust and Trading Partner e-Readiness are issues of concern that are unique to the environment of conducting EDI over the Internet and can influence the adoption decision of web-based EDI. Thus, this study includes these factors.

A quantitative survey approach was selected for this research, as it is an effective means for the collection of a large quantity of data in a time-efficient manner (Sekaran, 1984; Galliers, 1991). Furthermore, it can also provide 'snapshots of practices or views at a particular point in time from which inferences may be made. In this way, it can be used to describe real-world situation and make appropriate generalisations (Galliers, 1991). It also has the advantage of being able to focus on problem solving and pursue a rigorous method to identify problems, gather data, analyse the data and draw valid conclusions (Sekaran, 1984). A quantitative survey approach is particularly useful when a research (such as this study) has clearly defined independent and dependent constructs and a plausible model of the expected relationships that are examined against observations of the phenomenon (Pinsonneault and Kraemer, 1993).

Therefore, a quantitative research method via a survey approach is adopted to investigate and examine several aspects of web-based EDI adoption in the container liner shipping industry. Consistent with our research purpose of studying how social and relational factors attribute to web-based EDI adoption, we specify the *extent of web-based EDI adoption* as the dependent variable measured by breadth, volume and depth.

A set of questionnaires ware developed from a pool of survey instruments that have been tested and used in these studies. Drawing from such a pool improves content validity of the adapted items. Furthermore, new items were developed to address issues related to the Internet. The new items in the instrument are related to: social network effects, and guanxi.

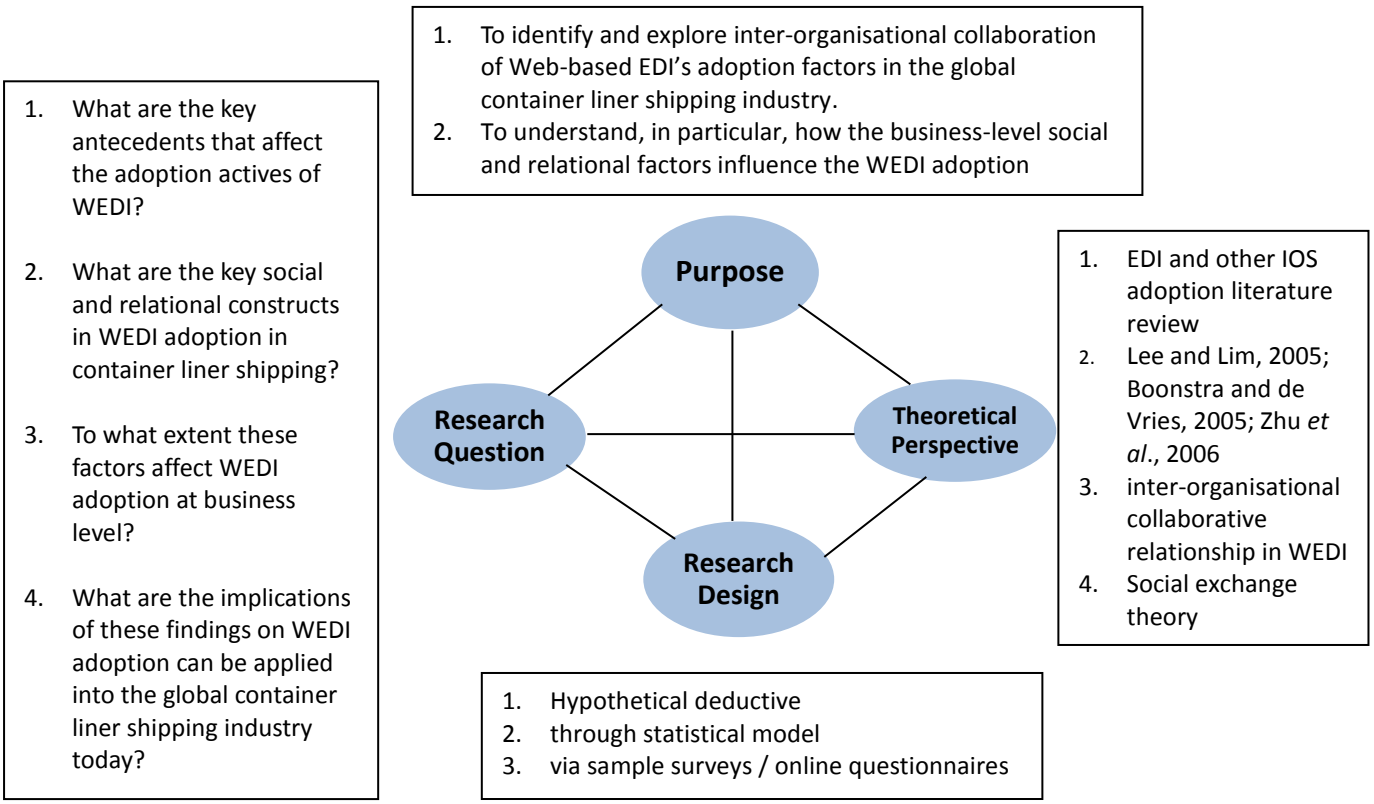
4.2 Research Approach

This study adopts a positivism position. Figure 4.1 summarises the key aspects of this study, and will be discussed further later in this chapter. The primary aim of this study is identify and explore inter-organisational collaboration of Web-based EDI's adoption factors in the global container liner shipping industry to understand, in particular, how the business-level social and relational factors influence the WEDI adoption.

Based on previous literature review on EDI and other inter-organisational systems adoption as well as the three key inter-organisational system adoption empirical research (Lee and Lim, 2005; Boonstra and de Vries, 2005; Zhu *et al*., 2006), an integrated conceptual model is established showing the relationships of the key constructs, which are then tested quantitatively by 3 different online surveys. After examining its reliability, validity and correlation of the constructs, PLS structural Equation Modelling is applied to test hypotheses to improve the current understanding of social and relational aspects of WEDI adoption factors

This study is hypothetical deductive through statistical models via sample surveys and online questionnaires, rather than inductive and theory building, rather than theory building. Regarding to the key aspects of this research, a brief summary of the research philosophy is shown in Figure 4.1 as below.

Figure 4.1: Research Philosophy: Key Aspect of the Research



Researchers in a variety of disciplines may have found the Internet a very useful way for conducting survey research. As the cost of computer hardware and software continues to decrease and the popularity of the Internet increases, more segments of society are using the Internet for communication and information (Nie *et al*., 2002). Thousands of groups and organisations have moved online, many of them aggressively promoting their presence through the use of search engines, and e-mail lists. These organisations not only offer information to consumers, they also present opportunities for researchers to access a variety of populations who are affiliated with these groups.

Previously, researchers often used word-based e-mail surveys, which involved creating online survey forms using word processing software. Researchers had to 'cut and paste' responses from the e-mail responses into statistical software programs such as SPSS (Wright, 2005). More recently, online survey creation software packages, such as Zoomerang, provide a more advanced web-based software packages to create and implement online surveys more easily, as well as to export data (in different types of

format) to suit different types of statistical software packages.

Online surveys are also different from conventional mail, telephone, and intercept surveys in a number of important ways. First, the online survey allows researchers to access a large population without restrictions on the geographic boundaries (Schmidt, 1997), and thus is potentially much less expensive than conventional survey methods (Tse, 1998; Watt, 1997). It also guarantees fast response (Watt, 1997; Weible and Wallace, 1998) by allowing immediate delivery of the instrument (Litvin and Kar, 2001), easy feedback, and verifiable delivery (James *et al*., 1995). Last but not the least, it encourages interactivity, enabling researchers to design more complex and dynamic instrument (Schmidt, 1997; Watt, 1997; Weible and Wallace, 1998) such as ranking or adaptive questions.

In this research, in order to improve the current understanding of those social and relational aspects of web-based EDI adoption factors, also to provide an understanding of exactly how business in global container liner shipping exchange data with other firms, especially, to what extend the web-based EDI have been adopted, and how the nine constructs would have their impact to the adoption of web-based EDI, a special quantitative approach of E-mail and Web survey via E-mail Extractor, E-mail Verifier and Zoomerang was introduced for the data collection.

To test the proposed research model and hypotheses, we used a dataset generated from a large-scale E-mails and Web-based survey designed for studying the extent of web-based EDI adoption by firms. The data gathering process was carried out through four major steps: (1) Fast E-mail Extractor (FEE) (2) Fast E-mail Verifier (FEV) (3) Create, launch the web survey and send the survey invitation (and reminder) through e-mails through Zoomerang (4) Use Zoomerang's web-based software package to collect data and further analyse the data in statistic software, SPSS.

First, in search of e-mail addresses and harvest the user names and email addresses based on the requirements (specified by the user), Lencom's industrial strength software of Fast E-mail Extractor (FEE) is used to target the potential respondents' e-mails directly from

some specified websites, providing the comprehensive ability to extract information from several known websites. Several inappropriate or irrelevant web sites were manually removed from further scanning. Although the e-mail ids appear to be difficult to obtain in today's world of information and technology, FEE appears to be greatly helpful to gather this crucial information in this study.

By specifying a directory list of the sites relevant to the targeted field, the e-mail ids of potential respondents were extracted from company websites that have e-mail ids embedded. Designed to collect the contacts of businesses from their web pages on the Internet (like the HTTP and the HTTP protocols, HTML and text files present on the local disks), FEE efficiently scans the websites and pulls out the relevant e-mail addresses of people likely to belong to its category in a relatively short period (depending on the specified scan depth and paths defined by user). The tool saves the e-mail address lists in a database and do not visits the same website's twice, and avoid the duplication of e-mail ids. In addition, by using the rich filtering options, the unwanted e-mail addresses are avoided. After using the extractor, the results are saved excel format and were edited, sorted and exported to the Fast E-mail Verifier (FEV).

Second, in order to present the quality of the extracted e-mail addresses, the next step involved with Lencom's verifying tool, Fast Email Verifier (FEV), which contains a powerful functionality for importing e-mail lists, checks a validity of e-mail addresses, and exporting the outcome of the verified e-mail addresses to different resources. Based on the new advanced .Net technology, the software provider, Lencom (2003) suggests this verification tool is able to identify about 85% of the 'dead' e-mail addresses that do not allow determining the correct number of valid e-mail addresses. FEV also checks the remaining 10 to 20% of mail servers received messages for validity and return message regarding problems with addresses, and then separate bad and good lists are created for optimised Bulk Email Campaign. Operations allowed: Remove Duplicates, Sort E-mail List, Split E-mail List, Combine E-mail Lists, Filter Lists with specific words, Remove List Management, Verify and Validate E-mail Lists, and Create Sample Lists into different formats. The advantage of using FEV is that because it connects directly to their SMTP server, verify, validate, and remove duplicated e-mail addresses, nothing was sent to the targeted recipients, meaning

that there is no need to disturb anyone to check if their email addresses or domains are still valid.

Today, despite possibly being separated by great geographic distances, online survey service providers allow the researcher quickly and effective gain access to large numbers of different individuals in a more user-friendly and anonymous approach. Advantages of this Internet-based surveys include the ability to reach the unique or difficult to contact participants, the convenience of having automated data collection, the possibility of allowing the participants to view the survey results immediately, and the anonymous function, which allows participants to keep information confidential.

In addition, web survey offers an interactive and user-friendly type of web page that allows Internet users to send information across computer networks, for the data collection from the participants. After completing the web survey, participants click on a "submit" button on the webpage. This transmits the survey responses to the researcher. Online survey questions are the same types as on a traditional questionnaire, only the participants submit the information over the Internet rather than return questionnaires in person or by mail. Since most Internet users are quite familiar with Web forms since search engines, including Yahoo! and Google, are sophisticated forms. Online survey products also provide a variety of useful questionnaire options, and a user-friendly process to develop online questionnaires. Given these advantages, the author decided to develop the survey by using an Internet-based commercial survey tool (Zoomerang: www.zoomerang.com).

Therefore, the third step is to create and launch the web-based survey by using Zoomerang's 'launch survey' service: an initial e-mail invitation that identified the purpose of the survey that relates to the study was sent and participants were asked to participate and were given an opt-out option if they were going to participate. Since accessing potential participants to participate in a survey by e-mail invitations can sometimes regard as a rude or offensive behaviour (Hudson and Bruckman, 2004), or consider this type of posting to be "spam" (Andrews *et al.*, 2003). This opted-out function gives the respondents the choice to participate as well as ensuring the quality of the data

by eliminating those unwilling to participate. Approximately two weeks after the initial mailing, a second reminding e-mail was sent to those of non-reply. This electronic message directs them to the web site where the survey instrument is located.

Finally, in addition to helping researchers to create online surveys, Zoomerang offers features that assist the data collection and analysis processes. Basic survey process features include tracking of survey respondent e-mail, e-mail response notification, and real time tracking of item responses. In addition, Zoomerang offers a required answer feature, which prevents survey data submission unless certain items are responded to, meaning the reduction in missing data, especially for key survey measures. Furthermore, Zoomerang offers a redirect feature to display a "thank you for participating" web page, or any web page a researcher chooses, after a participant submits the data to the researcher. Other basic features include the ability to share data with other researchers, enabling research teams with members at different locations to share survey results. Most importantly, Zoomerang offers the ability to export survey responses to statistical software packages in SPSS for further statistical analysis shown in the next chapter.

Despite the online surveys offer many advantages over traditional surveys, there are also disadvantages that should be considered when using online survey methodology.

First, investigators can encounter problems when conducting online research, such as regards sampling (Andrews *et al.*, 2003) For example, relatively little may be known about the characteristics of people in online communities, aside from some basic demographic variables, and even this information may be questionable (Dillman, 2000; Stanton, 1998). Therefore, strictly speaking, when the data were self-reported, there is no guarantee that participant from previous surveys provided accurate demographic or characteristics information.

Secondly, although some organisations provide staff e-mail contact lists that can help to establish a sampling frame. However, not all members of organisations allow their e-mail addresses to be listed, and some may not allow administrators to provide their e-mail addresses to researchers. Therefore generating accurate samples from organizations became difficult (Andrews *et al*., 2003). Theoretically, once an email list is obtained, it is

possible to e-mail an online survey invitation and link to every member on the list. However, problems such as multiple email addresses for the same person, multiple responses from participants, and invalid/inactive e-mail addresses make random sampling online a problematic method (Andrews *et al*., 2003). Two steps were taken in this research to minimise this error. First, Lencom's fast e-mail verifier was used to validate the quality of the e-mail addresses from their STMP server. Secondly, in order to prevent respondents from taking a survey multiple times, the survey invitations were sent via e-mail through Zoomerang. Because the user of Zoomerang online survey tool can set the system to allow the respondents take the survey only once before deploying survey. Once they have completed the survey, the survey program remembers the participant's email address and does not allow anyone using that email address access to the survey. This feature helps to reduce multiple responses, although someone could potentially complete the survey a second time using a secondary e-mail address (Konstan *et al*., 2005).

Third, one concern with this web-based approach has the possibility of low response rates and immeasurable non-response bias. To increase the validity of the research, we particularly ask the participant to enlist the help of their colleagues to assist in getting all questions answered as accurately as possible, and providing with a much more user-friendly design in the style of the web-page is applied to minimise the weakness of the approach. Nevertheless, this web-based approach facilitates the transfer of data to data warehouses. Results for a series of terms are stored in one place and are easy to access and manipulate. These data can then be used efficiently to conduct trend analysis or make comparison later on.

However, many of the problems discussed here are not unique to online survey research. Mailed surveys suffer from the same basic limitations. While a researcher may have a person's mailing address, he or she does not know for certain whether the recipient of the mailed survey is the person who actually completes and returns it (Schmidt, 1997). Moreover, respondents to mailed surveys can misrepresent their age, gender, level of education, and a host of other variables as easily as a person can in an online survey. Even when the precise characteristics of a sample are known by the researcher, people can still

respond in socially desirable ways or misrepresent their identity or their true feelings about the content of the survey. The best defence against deception that researchers may have is replication. Only by conducting multiple online surveys with the same or similar types of Internet communities can researchers gain a reliable picture of the characteristics of online survey participants. Hence, it becomes one of the reasons for the Case Study 1 as a pilot study.

Although web-based surveying raises some methodological issues, Dillman (2000) argues that "no other method of collecting survey data…offers so much potential for so little cost (p. 400)." There are many reasons for this. With a web-based survey, concerns with types of user and equipment capabilities are minimized (Bradley, 1999). Watt (1999) points out that the growing standardisation of browsers and communication software protocols as well as the widespread adoption of Java-language provide optimum tools for researchers to conduct successful online research. He also argues that lower-cost data collection via the Internet (in terms of time required for both collection and analysis of data) will result in larger samples with more statistical power and more useful results (Watt, 1999). Moreover, the use of E-mail extractors can help cut down the cost of using Google Adwords, Google Adsense or other pay-per-click programs. The e-mail list gives the researcher a sure-shot way of contacting prospects rather than putting up links on the web and then hoping that someone clicks on their site when it appears in a search result. E-mailing their link directly to the email contacts gives the researcher an edge on receiving replies from interested individuals. However, with companies avoiding the listing of email ids on their sites, the crawling approach is getting tougher for the email harvesters.

Although many of the problems discussed in this section are also inherent in traditional survey research, some are unique to the computer medium. Overall, there are many benefits via the Internet-based approach including greater flexibility in responding surveys, greater accessibility for participants to submit data, shorter the survey cycle time as well as a much lower administrative costs despite it may involve a large, one-time development costs.

4.3 Case Study 1 (Pilot Test) – December 2008

A pilot study is essential to fully test the measures. Case study 1 is essentially the pilot study administered during December 2008 and February 2009 through an online questionnaire. Initially, the research was focus in the Taiwanese liner shipping industry. The pilot data was gathered by means of an online survey tool of Zoomerang.

The data gathering process was carried out into four steps. First, one e-mail search engine software will be used to capture the potential samples. We key in the desired key words (i.e. container shipping) and define the targeted geographical location of the organisation's website (i.e. .com or .tw) to identify the company name, a contact person, an e-mail address for that person, an address, and a telephone number. The contact person is typically target the owner of the business of a top-level manager. Second, in order to increase the response rate, an initial e-mail invitation that identified the purpose of the survey that relates to the study was sent and participants were asked to participate and were given an opt-out option if they were not intend to take part. Third, in addition to the participation request, we also ask the potential participant to forward to those suppliers or trading partners who have already adopted the web-based EDI system, to increase the validity of the research. Finally, approximately two weeks after the initial mailing, a second electronic mailing will be sent to those of non-reply. This electronic message directs them to the web site where the survey instrument is located.

Participation to the survey was completely voluntary through self-completion. To complete the questionnaire, participants will need to access the web site and select to participate in research option link from the home page. Immediately following this section, a Web page displaying an informed consent from appeared. The informed consent form describes the voluntary nature of participation, assures strict confidentiality and offers the freedom to withdraw from participation at any time. Participation requirements and the purpose of the research will also be displayed on the informed consent page. In addition, the informed consent from also offers guidance in obtaining additional information concerning this research.

Participants who accepted the terms of the informed consent form then selected the questionnaire link presented at the bottom of the consent form page. Upon completion of the survey, participants will be provided with the option to send the questionnaire, which resulted in the submission of the questionnaire into the server. Debriefing information outlining the purpose of the research and the availability of results is accessed through selection of the hypertext debriefing information link displayed at the end of the final section of the questionnaire. The debriefing pages also include a list of references for further reading on procrastination.

The survey instrument was designed on the basis of a comprehensive literature review and interviews of managers, and was refined via several rounds of pre-tests and revisions. Each of the items on the questionnaire was reviewed by an expert panel for its content, scope, and purpose (content validity).

In order to test the questionnaire, and to avoid eliminating any of the firms from the potential sample, it was administrated to a total of unique individuals in the shipping firms (n= 397) of Taiwan, who were asked to comment on the questionnaire in evaluating the reliability and face validity of the questionnaire. Problems or difficulties, such as ambiguity of wordings and misunderstanding of technical terms, were reported for further modification. The number of completed responses was 78, which was a response rate of 20%.

Face validity tells us to what extent the measure used seems to be a sensible measure for what it aims to measure (Saunders *et al.*, 2003). Bell (1999) concluded that some key factors should be considered for testing the validity of the questionnaire, including clarification of introductions, the layout, respondent feeling and wording. All of which will be been taken into account in into Case Study 1. Any ambiguous measurements were refined according to the respondents' advice.

The data were then analysed for reliability and validity. SPSS version 16.0 was used as the statistical analysis tool. Factor analysis was employed to test the validity in the first study. Principal Component Analysis (PCA) was used to investigate the presence of components

with eigenvalues exceeding 1. In addition, a screeplot was created to indicate the number of factors appearing to represent underlying conceptual constructs in the data.

In terms of the reliability, the internal consistency reliability test was conducted to measure "the degree to which items in a test measure the attribute in a consistent manner" (Tashakkori and Teddlie, 1998). The recommended measure of the internal consistency of a set of items is provided by Cronbach's alpha, an estimate of the average of all possible mistakes and measures the extent to which individual items 'hang together'. The general norm is that alpha coefficient should be higher than 0.7 for the satisfactory to a reliable internal consistency (Nachmias and Nachmias, 1992).

Therefore, an alpha test was employed for the reliability analysis against the minimum standard of internal consistency of 0.7 in making sure different dimensions in the survey measure the same issue so that literature would support the measurements and questionnaire design.

The result shows the Alpha value of each construct is largely exceed the minimum standard of Internal Consistency of 0.7, except the contract of *Trading Partner Power* (α=0.601). This indicates that the scale could almost be regard as reliable, meaning that the different dimensions in the survey measure the same issue; literature supports the measurements and questionnaire design. Particularly, the new modified dimensions – *Technology Trust*, *Social Network Effect* and *Guanxi* – receive high Alpha values (i.e. 0.955, 0.891 and 0.918 respectively).

The low value of R^2 in *Trading Partner Power* also suggests the need for the third item. Nevertheless, the overall results supported that these constructs are reliable and valid in the survey. However, this pilot test also indicated that a few of the items that shows low R^2 value or less value of 'α if item deleted' (such as TMC7, SNE7, GX1, GX7) suggest that these items are not as reliable as the others. Hence, these items should be removed from the questionnaire, so that the new questionnaire can be better measured the nine constructs.

The implications from this first case study were that the original 56 items were reduced to 53 items. Furthermore, based on the results from this Case Study 1, some questions in the survey questionnaire were re-worded for clarity. All the revised items in the survey were verified and back translated by the experts to ensure the accuracy before conducting the main data collection.

4.4 Case Study 2 - June 2009

After the Case Study 1, the corresponding revisions was made to the questionnaire based on the feedbacks, in an effort to identify elements of web-based EDI adoption, the Case Study 2 was launched during the period of June to October, 2009 to over twenty companies with major global container liner shipping activities. This online survey (via Zoomerang) provided an understanding of exactly how business in the container shipping exchange data with other firms, to what extend the web-based EDI have been adopted, and how the nine constructs would have their impact to the adoption of web-based EDI and how the web-based EDI are being used.

Based on UNCTAD's list of the top 20 container carriers (See Table 4.2), the sampling frame was assembled from the *Review of Maritime Transport*, 2008 (RMT), one of United Nations Conference on Trade And Development's (UNCTAD) flagship publications, published annually regarding on the worldwide evolution of container shipping. Based on the number of ships and total shipboard capacity deployed (TEUs), this list included the ranking of the top 20 container shipping liners, accounted for about 70 per cent of the total global container capacity deployed (UNCTAD secretariat, 2008, p80). Therefore, these twenty liners were chosen to be the targeted firms in this study, representing the global container liner shipping industry.

Table 4.2: Twenty Leading Service Operators of Containership in 2008 (Number of ships and total shipboard capacity deployed (TEUs))

Ranking	Operator	Country/territory	No. of ships in 2008	TEU capacity in 2008
1	Maersk Line	Denmark	446	1 638 898
2	MSC	Switzerland	359	1 201 121
3	CMA-CGM Group	France	238	701 223
4	Evergreen	Taiwan Province of China	177	620 610
5	Hapag Lloyd	Germany	142	491 954
6	COSCON	China	141	426 814
7	CSCL	China	122	418 818
8	APL	Singapore	117	394 804
9	OOCL	Hong Kong (China)	84	351 542
10	NYK	Japan	87	331 083
Subtotal			**1 913**	**6 576 867**
11	MOL	Japan	104	325 030
12	Hanjin	Republic of Korea	74	321 917
13	K Line	Japan	91	293 321
14	Yang Ming	Taiwan Province of China	83	276 016
15	Zim	Israel	84	243 069
16	Hamburg Sud	Germany	76	196 632
17	HMM	Republic of Korea	45	194 350
18	PIL	Singapore	72	140 135
19	Wan Hai	Taiwan Province of China	75	125 393
20	CSAV	Chile	48	108 927
Total 1-20			**2 665**	**8 801 657**
World container cellular fleet at 1 January 2008			**8 762**	**12 657 725**

Source: UNCTAD secretariat, Containerisation International Inline, Fleet Statistics, www.ci-online.co.uk

The survey instrument went through four phases of extensive pretesting before administration. First, based on the feedbacks and the outcome from Case Study 1, the instrument was reviewed by faculty for comprehensiveness, clearness and coherence. Second, designed to collect the contacts of businesses from web pages on the Internet, Lencom's Fast E-mail Extractor (FEE), was used to effectively scans the websites and extract the relevant e-mails directly from each of the top twenty container carrier's company website, providing the comprehensive ability to extract information from several known websites that have e-mail ids embedded. Obviously, several inappropriate or irrelevant websites were manually removed from further scanning. Thirdly, after using the FEE, the results were saved in excel format and were edited, sorted and exported to the Fast E-mail Verifier (FEV), which connects directly to the SMTP server, to verify, validate, and remove duplicated e-mail addresses for checking the quality of e-mail addresses

without disturbing anyone to check if their email addresses or domains are still valid.

Due to the time and cost constraints it was not possible to collect the data to use a simple random sample from the original databases of the firms, and a stratified random sampling method was attempted in order to carefully identify firms who are using any of the technologies, such as EDI or web-based EDI, for their supply chain activities. Out of 5,002 valid and unique e-mail addresses, we have selected 2,000 respondents as the sample for this research. Finally, the survey was executed by Zoomerang online survey tool, sending e-mails to the 2,000 samples.

However, out of the 2,000 samples, 198 of them have chosen to be opted-out and 768 of them were bounced back for some unknown reasons. This leaves it an effective sample of 1,034. Ideally, eligible respondents are those executives or managers best qualified to speak about the firm's overall computing activities. For medium or large firms, the respondent is hope to reach vice president or a senior manager with information system responsibilities; CEO, president or managing director for small firms. It is believed that the sample size, though not large, is significant since it specifically targeted and reached knowledgeable users of information technology in these companies.

The invitees were informed that the goal of the survey was to explore and understand factors that affect adoption of web-based EDI in the global container shipping industry, and they were assured that the results would be reported in aggregate to guarantee their anonymity. Given the study's need to assess collective organisational perceptions, the key respondents were asked to evaluate the perceptions of the entire group of people responsible for their firm's experiences in web-based EDI adoption. To motivate organisations to respond, the respondents were offered a report that summarised the results of the survey and compared their company against other firms. The initial mailing received 124 usable responses. One follow up e-mail reminder was sent to each of those non-responding samples three week after the initial mailing and an additional 40 usable responses were returned. Overall, there are 164 unique and valid responses out of the effective sample of 1,034.

4.5 Survey Development

The survey used for Case Study 2, which consisted of thirty questions grouped in twelve categories, was conducted to gather current data on web-based EDI adoption in global container liner shipping industry. The questionnaire design includes questions related to the characteristics of the respondent and responding firms. Items used to measure the variables were adapted from modified scales in the literature. Every questionnaire begins with the purpose of the research, expected outcome from the participation, more importantly, is the confidentiality of using these collected data. It was also designed to be completed by participants with minimum effort. Most questions were in multiple-choice format, which allowed participants to quickly select one or multiple answers that best applied. Also, a comment field for any additional input or other possible answers that were not listed was employed at the end of the questionnaire. Scopes of questions covered by the survey included:

1. Whether or not the firm uses web-based EDI;
2. Ways of exchanging data with firms if not using web-based EDI;
3. Information to the usage of web-based EDI in terms of the breadth, volume and depth;
4. Measurement to the nine constructs of web-based EDI adoption factors;
5. General information of the participant and the company with which he/she works;
6. General comments on web-based EDI adoption in the container shipping industry.

Respondents were typically asked: 'Please rate your level of agreement with each statement.' Respondents were assessed based on a seven-point Likert-type scale, that is, of strongly agree =7, of neither agree nor disagree =4, of strongly disagree =1. A seven-point Likert scale is employed as it has been most recommended by the researchers since it reduces the frustration level of respondents and increases response rate (Sachdev and Verma, 2002). The questions were mostly closed, meaning that will be converted to a numerical format in order to be tested (Pallant, 2001). The online questionnaire is provided in Appendix 4.

In order to obtain reliable information through the survey, one pilot study (Case Study 1) was completed in February 2009 prior the Case Study 2. Through previous working experience, and continuous close ties to the container shipping industry in East Asia it was able to call upon knowledgeable practitioner and industry expert to ask for the opinion to this survey. The survey methodology involved: 1) An e-mail contact containing a link to the online survey to known users of web-based EDI inviting them to take the survey. 2) Participants were asked to enlist the help of their colleagues to assist in getting all questions answered as accurately as possible. 3) A follow-up e-mail was sent thanking the participant. Reminder e-mail was sent three weeks after the initial invitation e-mail. 4) An executive summary of our finding was sent to those requested participants containing a link that shared the survey results with all participants.

Fifty days after its launch, the survey ended with a saturated and satisfactory result: 824 visits and 164 completed responses. A study of the data collected from the responses followed. Some of the findings of this study are explained in Chapter Five.

4.6 Measurements of Constructs

To enhance the content validity of the measurements, a number of steps were taken. First, followed by an intensive study of the literature, valid measurements for the related constructs are identified. The existing measurements that had been used in previous studies were adopted wherever possible into the context of container shipping. Second, the questionnaire was further revised based on the inputs provide by the pilot test. Third, two container shipping managers individually reviewed the questionnaire for suitability, readability and ambiguity to finalise the questionnaire before the launch of the final survey.

We began the instrument development process with a comprehensive review of the literature prior studies that contained scales for the constructs used in this study. Since existing scales that were proven to be reliable and valid measures were available for most of the constructs, we adapted them to the context of this study. This included successive stages of theoretical specification, statistical testing, and refinement (Straub, 1989).

Multiple item measures were used to assess the research constructs. All constructs were measured with multiple items on seven-point Likert scales, ranging from 1 (strongly disagree) to 7 (strongly agree). All constructs in the research model were measured using existing or new multi-item scales (See Appendix 2). Six constructs were developed based on excising scales (*Trading Partner Power, Trading Partner Dependence, Trading Partner Trust, Top Management Commitment, Perceived Interests, Technology Trust,* and *Trading Partner e-Readiness)*, two constructs were newly developed (*social network effect* and *Guanxi*).

The Dependent Variable: Web-based EDI adoption

Adopted from Zhu *et al.* 's (2005) previous conceptualisation in open-standard inter-organisational system adoption, *web-based EDI adoption* is modelled as a second-order construct reflected by three first-order dimensions—breadth, volume, and depth. *Breadth* is measured by the number of container shipping process, for which a firm has adopted the web-based EDI. *Volume* is measured by the percentage to which each of the major container shipping activities (e.g., shipping order, bill of lading, and import export manifest) has been conducted on the web-based EDI platform. Based on previous studies on data integration (Goodhue *et al*. 1992), *depth* is measured by the extent to which web-based EDI have been integrated with back-office systems and databases, and with suppliers' databases (Zhu and Kraemer, 2005).

The Independent Variables:

The first two items for *Trading Partner Power* were directly adapted from the validated multi-item scales from Hart and Saunders (1998) for Case Study 1. In the Case Study 2, one additional item was created in addition to Hart and Saunders' (1998) study. These three items measured the extent of trading partner's power behind their reason of web-based EDI adoption.

Trading Partner Dependence was measured using four items adapted from Premkumar and Ramamurthy (1995). These items measure a firm's dependence on its suppliers and the reciprocal dependence of suppliers on the firm. The measurement was based on responding firms' perceptions of their interdependence with their suppliers.

Trust is defined as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other party will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party." (Maye e*t al.*, 1995). *Trading Partner Trust* in this study measures the firm's trust to its EDI trading partners. The eight items for *Trading Partner Trust* was adapted from a previously validated multi-item scale used to measure a closely related construct found in Hart and Saunders (1998). The measurements of the firm's trust towards its EDI trading partners were measured by eight sets of aspects in this construct, including honesty, accuracy, reliability, willingness of sharing information and consistency, etc.

Top Management Commitment, in this study, measures the extent of the organisation's top management commitment in terms of the knowledge and good understanding in web-based EDI, involvement in web-based EDI, extent through the supply chain, extent of persuasion of employees to participate web-based EDI, establishment of a complete performance measurement system, delegation of authority in adopting web-based EDI, and his ability of managing the transition. All of these measures were adopted from Ngai *et al.* (2004).

Perceived interests commonly refer to potential gains received by organisations engaging in inter-organisational activities, such as web-based EDI. Drawing upon the study of Ranganathan *et al*. (2004), six items were used to assess the *perceived interests* for web-based EDI. These items measured the extent to which web-based EDI resulted in improvements pertaining to customer service, cost reduction, inventory management, cycle-time reduction, supplier-relationship management, and generation of competitive advantage.

Technology trust, in this study, measures ''the subjective probability by which organisations believe that the underlying technology infrastructure is capable of facilitating transactions according to their confident expectations'' (Ratnasingam and Pavlou, 2003, p22). The scale for *Technology Trust* was adapted from Ratnasingam (2005). Specifically, the *Technology Trust* is measured by the following aspects: (a) confidentiality mechanism that aim to protect e-commerce transaction and message content against

unauthorised act using encryption mechanisms; (b) integrity mechanisms that provide transaction accuracy and assurance that e-commerce transactions have not been changed; (c) authentication mechanisms that provide transaction quality of being authoritative, valid, true, genuine, worthy of acceptance; (d) non-repudiation mechanisms that protect the originator of e-commerce transactions and use acknowledgement procedures applying digital signatures; (e) access control mechanisms that provide authorisation mechanisms thereby assuring that transactions are sent and received without interruption; (f) availability mechanisms that protect transactions against weakness in the transmission media and protect the sender against internal fraud or manipulation by using authorisation mechanism such as user IDs and passwords.

As a firm links up electronically with more and more of its trading partners it develops the experiences and know-how to make further adoption somewhat easier. *Trading Partner eReadiness*, in this study refers to the degree of expertise and experience in place at the target firm at the time of the particular web-based EDI project being examined, measuring the willingness and ability to adopt web-based EDI. *Trading Partner eReadiness* is measured by four items adopted from Lin (2006). Specifically the following aspects of trading partner in terms of the extent of their previous request of adaptation of web-based EDI, previous recommended adaptation of web-based EDI, technical expertise, and knowledge. Details of the constructs and items are provided in Appendix 2.

4.7 Response Rate and Non-Response Bias Control

Out of the 2,000 samples, 198 opted-out, 768 undeliverable, resulting in an effective sample of 1,034. In the end, there are 824 visits in total, consists of 191 partial attempted questionnaires and 164 completed questionnaires. Out of these 164 unique and valid responses, 113 (68.9%) of them adopted web-based EDI in their business activity, the rest 51 (31.1%) respondent firms did not; resulting in an effective response rate of 15.9%, which is comparable to similar studies (Ranganathan *et al*., 2004; Soliman and Janz, 2004). In general, response rates greater than 20% are recommended in supply chain management research (Prahinski and Benton, 2004; Pagell *et al.*, 2004). However, this sample size met the level of 100 and above that Hair *et al.* (1992) recommended for providing valid results.

Response bias is always a concern in survey research, especially when the response rate is low (Ranganathan *et al.*, 2004). To solve these problem two important steps were taken. Following Armstrong and Overton (1977), the early respondents and late respondents were compared on a number of parameters. The logic of this comparison is that late respondents tend to closely resemble non-respondents (Kanuk and Berenson, 1975).

Non-respondents bias was checked by comparing early and late respondents firms on all the key research constructs in the model. The t-test revealed no significant differences emerged in the mean responses on any of the constructs. Lastly, on the assumption that a significant correlation between items scores and survey response time would indicate response bias, all the correlation between the mean scores of the research construct and response time were examined, and none were significant.

Non-response bias was assessed by a comparison of sample statistics to known values for the population between (a) respondents and non-respondents and (b) early and late respondents. Early respondents were identified by selecting those that responded during the first week (76%), against those responding later (24%). These tests were based on sample characteristics – (a) annual handling amount of TEU, (b) number of employees, and (c) geographic location, and the actual scale responses. Both tests showed no significant differences for these three characteristics at the $p<0.1$ level; therefore, the risk

of non-response bias to the internal validity of this study's results is restricted. Together, these results suggest that non-response bias were not a major problem, and that our sample can be considered as fairly representative of the population.

Our final dataset contains 164 respondents. Table 5.1 shows the sample characteristics. Of the 164 respondents, 68.9% of firms (*N*=113) used web-based EDI and 31.1% of firms (*N*=51) did not. The distribution of firms by size reflects a balance of large and small businesses. We tested non-response bias and no statistically significant differences were found. We also examined the so-called “common method bias” which can potentially occur in survey data (Podsakoff *et al.*, 2003). The results of Harman’s single-factor test (Podsakoff *et al.,* 2003) suggest no significant common method bias in our dataset.

4.8 Ethical Considerations

Because the researcher is aware that accessing potential participants to participate in a survey by e-mail invitations can sometimes regard as a rude or offensive behaviour (Hudson and Bruckman, 2004), or consider this type of posting to be "spam" (Andrews *et al.,* 2003). Several steps had been taken to ensure participate that we have taken ethical consideration during the process of data collection in both studies.

First, prior the launch of the survey when extracting and verifying the e-mail address, two software of Lencom- E-mail Extractor (FEE) and Fast E-mail Verifier (FEV) provide several ethical implications in our approach to collect the respondents’ valid e-mail addresses. In the initial process of extracting e-mails, FEE was used to target information published from so specified websites. By specifying a directory list of the sites relevant to the targeted field, the e-mail ids of potential respondents were extracted from their company websites that have e-mail ids embedded. Since FEE saves the e-mail address lists from the company websites, which is publicly available, therefore, the FEE approach is ethical regarding to the data source. In addition, Based on the new advanced .Net technology, Lencom’s FEV was used to identify the ‘dead’ e-mail addresses from the output of FEE, and then separate bad and good lists are created for Zoomerang email survey campaign. Because FEV connects directly to their SMTP server, verify, validate, and remove duplicated e-mail addresses, nothing was sent to the targeted recipients, meaning that

there is no need to disturb anyone to check if their email addresses or domains are still valid. FEV approach is ethical regarding to the validity of the data source.

Second, the importance of conducting the survey was explained, contact information, as well as credentials of the researcher and the institution (such as, university banner and researcher's title and signature) was provided in the covering letter of the e-mail invitation message (see Appendix 3). This helps to enhance the credibility of the survey and it can create opportunities for email interaction between the researcher and participants. This is valuable, especially when participants have questions for further concern about the survey or other questions.

Third, despite an electronic response is never truly anonymous, since researchers know the respondents' e-mail addresses from one way or another, researchers are ethically required to guard the confidentiality of their respondents and to assure respondents that they will do so (Goree and Marszalek, 1995). This requirement is reflected in the e-mail invitation covering page, the respondent's data was promised to be treated confidentially, and only used in an aggregate form only. This assurance also appears twice on the greeting page of the online questionnaire to reassure the respondents (see Appendix 4).

Forth, this study provides the choice for those who prefer not to participate in the survey. Within the covering letter of the e-mail invitation message, participants were asked to participate followed by an URL to click as well as given an opt-out option for those who do not want to participate and delete their contacts from our e-mail reminding list.

Finally, in order to foster a good will with the community participants, an incentive was offered to provide an executive summary of the survey results to those interested in. For those who would like to request the survey results, an e-mail address was provided by the participant. A study report, highlighting the most interesting results was generated by Zoomerang after closing of the survey on a web page. An email with the URL link to the page was sent to those 129 requested respondents. Study results were presented in graphs with key statistics so that audience members can understand, learn about the results and their possible implications.

Chapter 5

Data Analysis

This chapter initially presents the collected data by giving a review of demographic profile of the respondents. Next, the use of PLS structural equation modelling and its alternative is used and evaluated prior to test the hypotheses. Measurement validation is addressed to establish its reliability and validity.

5.1 Case Study 2: Descriptive Statistics

A summary of the demographic characteristics of the sample is presented in Table 5.1. Of the 164 responses received, about half of the companies had fewer than 50 employees. Four major types of firms, namely (i) Container Shipping Carrier (ii) Shipping Agent (iii) Freight Forwarder, and (iv) Terminal Operator, constituted 90% of the respondents. Overall, about 70% of firms (*N*=113) had adopted and used web-based EDI to support their daily shipping operations. This indicates that global container line shipping industry has been aggressively adopted web-based EDI in their organisations.

Table 5.1: Demographic Profile of Respondents

	Frequency and (%)		Frequency and (%)
Job Title		**Type of the Firm**	
Vice Present or above	19 (12%)	Container Shipping Carrier	69 (42%)
Director or Vice Director	27 (16%)	Shipping Agent	46 (28%)
Manager or Assistant Manager	64 (39%)	Freight Forwarder	25 (15%)
Information System Staff	11 (7%)	Terminal Operator	9 (5%)
Operational Staff	18 (11%)	Inter-model Operators	1 (1%)
Marketing/ Sales Representative	24 (14%)	Importer or Exporter	1 (1%)
Other	1 (1%)	Others	13 (8%)
Total	164 (100%)	**Total**	164 (100%)
Years of Working Experiences		**Geographic Location of the Firm**	
1 or below	10 (6%)	Asia - East (China, Pacific OECD Asia)	54 (33%)
1 ~ 5	47 (29%)	Asia - West (Central, Middle East & South Asia)	43 (26%)
6 ~ 10	37 (23%)	Europe / Africa	39 (24%)
11 ~ 15	25 (15%)	North America	16 (10%)
16 ~ 20	17 (10%)	Latin America	12 (7%)
20 or above	28 (17%)	**Total**	164 (100%)
Total	164	**Service Routes**	

Firm Size (Number of Employees)		Fast East / Europe	97 (59%)
Small (Up to 49 employees)	82 (50%)	Inter-Asia	87 (53%)
Medium (Between 50 & 249 employees)	53 (32%)	America/ Europe	84 (51%)
Large (More than 250 employees)	29 (18%)	Fast East / America	78 (48%)
Total	164	Others	53 (32%)

Source: Case Study 2

- **Job Title**

Table 5.1 above shows the summery of the 164 responses according to their job titles. With little adjustment, more than 67% of respondents were classified by title as either 'manager/assistant manager', 'director or vice director' or 'vice president or above'. Most of the respondents (39%) are 'manager/assistant manager'. This distinction is important since managers and senior managerial staff may involve and anchor the process of EDI adoption in their business. Thus, the high percentage response from managers or above reflects the reliability of this research. By comparison with the adopter and the non-adopter of the web-based EDI based on the 164 samples, Table 5.2 also shows similar pattern of the distribution based on job title, also shows high percentage response from managerial level (more than 64% of the adopter and 72 % of the non-adopter).

Table 5.2: Job Title:
Adopter vs. Non-Adopter of Web-based EDI

Does your org use Web-based EDI?		Frequency	Percent	Cumulative Percent
Yes	Vice President or above	13	11.5%	11.5
	Manager or Assistant Manager	18	15.9%	27.4
	Director or Vice Director	42	37.2%	64.6
	Information System Staff	7	6.2%	70.8
	Operational Staff	12	10.6%	81.4
	Sales Representative	21	18.6%	100.0
	Total	113	100.0%	
No	Vice President or above	6	11.8%	11.8
	Manager or Assistant Manager	9	17.6%	29.4
	Director or Vice Director	22	43.1%	72.5
	Information System Staff	4	7.8%	80.4
	Operational Staff	6	11.8%	92.1
	Sales Representative	3	5.9%	98.0
	Others	1	2.0%	100.0
	Total	51	100.0%	
Overall	Total	164	100.0%	

Source: Case Study 2

- **Years of Working Experiences**

In order to understand how well the respondents actually understand or able to represent the company's view on participating in web-based EDI systems, respondents were asked to indicate how long they worked in the current organisation. Table 5.1 above shows that only 6% of respondents have worked less than a year. More specifically, almost 65% of respondents have worked more than 5 years, which suggests that respondents have abundant experiences to represent the shipping liner in reflecting the company's relative importance in the process EDI adoption. Again, based on the years of working experiences, Table 5.3 shows the distribution differences between the adopter and non-adopter. It shows high percentage response from those working more than 5 years (more than 69% of the adopter and 46 % of the non-adopter).

Table 5.3: Years of Working Experience: Adopter vs. Non-Adopter of Web-based EDI

Does your org use Web-based EDI?		Frequency	Percent	Cumulative Percent
Yes	1 or below	6	5.3	5.3
	1~5	29	25.7	31.0
	6~10	26	23.0	54.0
	11~15	19	16.8	70.8
	15~20	13	11.5	82.3
	20 or above	20	17.7	100.0
	Total	113	100.0	
No	1 or below	4	7.8	7.8
	1~5	18	35.3	43.1
	6~10	11	21.6	64.7
	11~15	6	11.8	76.5
	15~20	3	5.9	82.4
	20 or above	9	17.6	100.0
	Total	51	100.0	
Overall	Total	164	100	

Source: Case Study 2

- **Firm Size (Number of Local Employees)**

The size of the firm in this study is measured by the number of employees based at the local firm. Small firms commonly refer to those less than 49 employees; whereas medium firms are those with employees between 50 and 249; while firms more than 250 employees commonly regard as large firms. Therefore, the firm size of each participating firm was obtained by asking respondents "approximately how many people are currently employed at your location?"

For those in the survey who have adopted the web-based EDI, Table 5.1 above shows that only 20.4% of the firms are large-size firm; while 32.7% belong to the medium-firm category, and the majority of the firms (46.9%) adopted web-based EDI are categorised as small firms. Meanwhile, when looking into those who has not yet adopted the web-based EDI(See Table 5.4), the data suggests that those large (11.8%) and medium (31.4%) firms show much less proportion than those smaller firms of not adopting the web-based EDI, however, there are still more than 55% of the small firms have not adopted the web-based EDI.

In another word, although small firms appears to adopt web-based EDI more than the medium or large firms and less proportion of medium or large firms chose not to adopt web-based EDI, there are still many small firms proportionally have not adopted web-based EDI.

Table 5.4: Firm Size:
Adopter vs. Non-Adopter of Web-based EDI

Does your org use Web-based EDI?		Frequency	Percent
Yes	Small (Up to 49 employees)	53	46.9%
	Medium (Between 50 and 249 employees)	37	32.7%
	Large (More than 250 employees)	23	20.4%
	Total	113	100.0%
No	Small (Up to 49 employees)	29	56.9%
	Medium (Between 50 and 249 employees)	16	31.4%
	Large (More than 250 employees)	6	11.8%
	Total	51	100.0%
Overall	Total	164	100

Source: Case Study 2

- **Primary Business Activity**

In this study, in order to understand what types of the organisation are coming from, respondents were asked to indicate the organisation's primary business activity. Out of the 164 responses, Table 5.1 shows the majority (42%) of respondents are from container shipping firms. Secondly, 28% of respondents are from shipping agents. 15% are from freight forwarders. 5% are from the Terminal operators. Only 1 % each is from Inter-modal operator and shipper. Generally speaking, this result suggests that this shipping survey have been successfully reached to those targeted groups within the global container shipping industry, representing and reflecting the company's view in the process EDI adoption. By comparing with the adopter and the non-adopter, based on this survey, Table 5.5 also shows that there are more portions of the Container Shipping Carriers adopted (51.3%) the web-based EDI more than those have not yet adopted (21.6%). On the contrary, for those firms working as the Shipping Agent or Freight Forwarder, Table 5.5 shows that there are more of those not yet adopted the web-based EDI than those have adopted (As Shipping Agent, 29.4% not yet adopted, compared with 27.4% have adopted; As Freight Forwarders, 19.6% not yet adopted, compared with 13.3% have adopted.)

Table 5.5: Primary Business Activity:
Adopter vs. Non-Adopter of Web-based EDI

Does your org use Web-based EDI?		Frequency	Percent	Cumulative Percent
Yes	Container Shipping Carrier	58	51.3	51.3
	Freight Forwarder	15	13.3	64.6
	Terminal Operator	5	4.4	69.0
	Inter- modal Operators	1	.9	69.9
	Shipping Agent	31	27.4	97.3
	Others	3	2.7	100.0
	Total	113	100.0	
No	Container Shipping Carrier	11	21.6	21.6
	Freight Forwarder	10	19.6	41.2
	Terminal Operator	4	7.8	49.0
	Shipping Agent	15	29.4	78.4
	Shipper / Importer / Exporter	1	2.0	80.4
	Others	10	19.6	100.0
	Total	51	100.0	
Overall	Total	164	100.0	

Source: Case Study 2

- **Geographic Location of the Firm**

Table 5.1 above shows the summary of the 164 responses according to their geographic location of the firm. Overall, 59% of respondents were classified location as either 'Asia-East' or 'Asia West', where majority (33%) of them came from 'Asia-East (China, CPA, Pacific Asia and Pacific OECD)' and the rest Asian location (26%) came from 'Asia-West (Central Asia, Middle East and South Asia).' About a quarter of the respondents (24%) were classified location as 'Europe/Africa.' 17% of respondents were classified location as either 'North America' or 'Latin America', where 10% came from 'North America' and only 7% came from 'Latin America'.

This result shows that this survey was collected from a good mix of sources in terms of the geographic location of the firms. This distinction is important since these data can truly give the global characteristics of the container shipping industry, particularly in the process of EDI adoption. Moreover, Table 5.6 shows similar distribution regarding to the firm's geographic location. Therefore, it appears that this good spread-out response from different continents reflects the global nature of this research as well as its reliability.

Table 5.6: Geographic Location of the Firm:

Adopter vs. Non-Adopter of Web-based EDI

Does your org use Web-based EDI?		Frequency	Percent	Cumulative Percent
Yes	Europe / Africa	27	23.9	23.9
	Asia - East (China & CPA, Pacific Asia & Pacific OECD)	36	31.9	55.8
	Asia - West (Central Asia, Middle East & South Asia)	29	25.7	81.4
	Latin America	11	9.7	91.2
	North America	10	8.8	100.0
	Total	113	100.0	
No	Europe / Africa	12	23.5	23.5
	Asia - East (China & CPA, Pacific Asia & Pacific OECD)	18	35.3	58.8
	Asia - West (Central Asia, Middle East & South Asia)	14	27.5	86.3
	Latin America	1	2.0	88.2
	North America	6	11.8	100.0
	Total	51	100.0	
Overall	Total	164	100.0	

Source: Case Study 2

- **Service Routes**

Based on these 164 participants, Table 5.7 below shows measures five different types of service routes their shipping service provider have been in operation or related to. It shows that for those 113 web-based EDI organisations, Far East/ Europe route is the most common service route they have been involved with at 74.3%; while 72.6% of the firms in the survey involved in inter-Asia route, 65.5% of the firms involved in America/ Europe service route, 64.6% of the firms involved in Far East/ America service route, and only 16.8 % of the firms indicate they also operate in some other service routes.

The result of the coverage of the container shipping service routes suggests that this survey have been covered good portion of the container shipping industry in terms of the service routes firm provided. More importantly, according to this survey, the result also appear to suggest that, for those adopted (around 70%) the web-based ED, firms are able to offer more of its service coverage than those have not adopted (only around 50%), despite the non-adopters offer more proportion in the 'Other Service Routes' category (24% compare with 16.8% of adopters). Table 5.8 shows the specific other service route and it can be argued that web-based EDI adopter able to offer greater coverage for the major global service route than those non-adopters.

Table 5.7: Service Routes:
Adopter vs. Non-Adopter of Web-based EDI

Service Routes

Does your org use Web-based EDI?			Far East / America	Inter-Asia	Far East / Europe	America / Europe	Other Service Routes
Yes	113	Frequency	73	82	84	74	19
		Percentage	64.6%	72.6%	74.3%	65.5%	16.8%
No	51	Frequency	21	25	30	27	12
		Percentage	41.2%	49.0%	58.8%	52.9%	24.0%

Source: Case Study 2

Table 5.8 Other Service Routes: Adopter vs. Non-Adopter of Web-based EDI

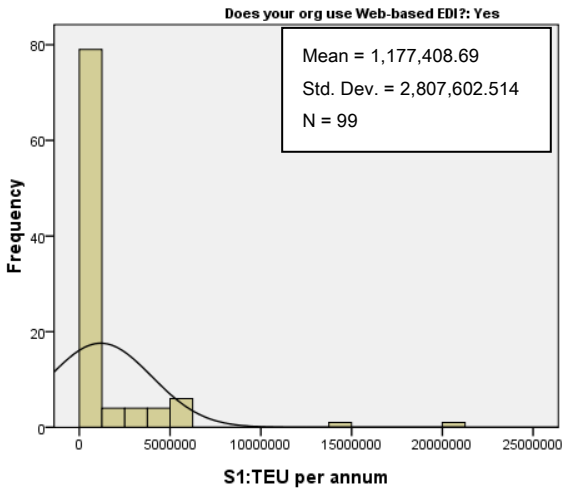
Does your org use Web-based EDI?		Frequency	Percent
Yes (113)	Africa	2	1.8%
	Africa, Australia and New Zealand	1	0.9%
	Australia	1	0.9%
	Australia / New Zealand	2	1.8%
	Caribbean and South America	1	0.9%
	Europe - Red Sea, - Indian Sub-Continent, - Levant	1	0.9%
	Europe / Caribbean	1	0.9%
	Europe / Africa	1	0.9%
	Gulf Middle East/India subcontinent	1	0.9%
	Inter-Latin	1	0.9%
	Intra Mediterranean	2	1.8%
	Middle East	1	0.9%
	North Europe, Baltic sea.	1	0.9%
	Red Sea/Asia, Europe, Mediterranean, West Africa	1	0.9%
	South America	1	0.9%
	West Africa/Europe, West Africa/Far East	1	0.9%
	Total	**19**	**16.8%**
No (51)	Africa	1	2.0%
	Asian Pacific	1	2.0%
	Central and South America	1	2.0%
	Europe/West Africa	1	2.0%
	Far East / Med; Europe/Med; Med/Med	1	2.0%
	Indian Sub-Continent	1	2.0%
	Intra Mediterranean	1	2.0%
	Middle East	1	2.0%
	Oceania-Asia	1	2.0%
	Turkey-Spain/North Africa	1	2.0%
	USA to Med, Europe to Turkey, Sweden to USA	1	2.0%
	USA-Carib, Europe-Carib, Inter-Caribbean	1	2.0%
	Total	**12**	**24.0%**

Source: Case Study 2

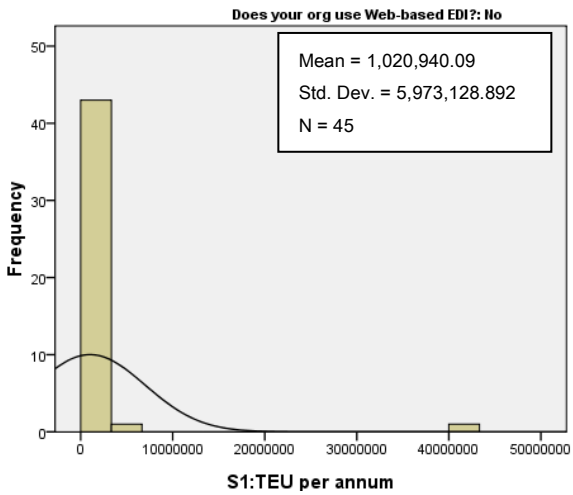
- **TEU per Annum**

In order to compare the influence of the web-based EDI adoption in the container shipping industry, the twenty-foot equivalent unit (TEU) per annum, an annual handling amount of cargo capacity based on the volume of a 20-foot-long (6.1 meter) container, was brought into the measurement. Figure 5.1 shows the frequency distribution of for both adopter and non-adopter of web-based EDI. According to this survey based on 99 adopters and the 45 non-adopters, the web-based EDI adopter, in average, can handle 150,000 (around 15%) more TEU per year than those non-adopters. Despite some of the data were unavailable, the outcome of the result certainly indicates the competitive advantage of using web-based EDI in handling container shipping industry.

Figure 5.1: TUE per Annum:
Adopter vs. Non-Adopter of Web-based EDI



Source: Case Study 2

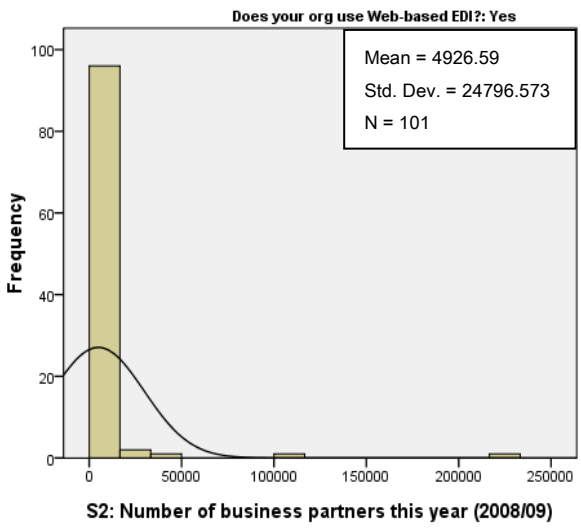


Source: Case Study 2

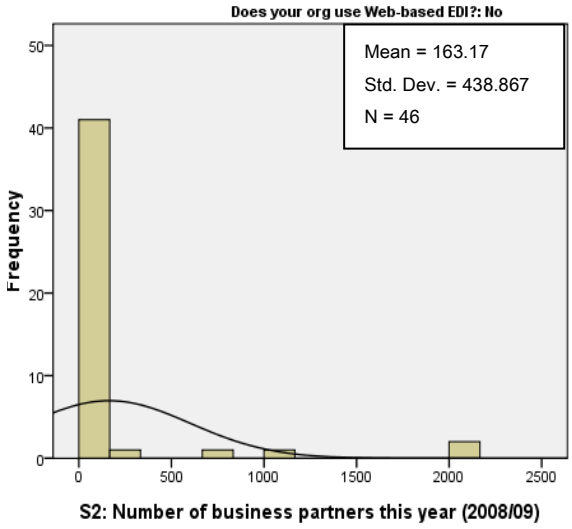
- **Number of Business Partners this year (2008/2009)**

This study also compares the number of business partners between the adopters and non-adopters. Figure 5.2 shows that based on the 101 adopters and 46 non-adopters, web-based EDI adopters on average has 4927 business partners over the year 2008/2009, compared with only 163 business partners for the non-web-based EDI adopter. Despite some of the data were unavailable, and the spread-out of the adopters' data is much higher than that of the non-adopter, the ability of connecting more business partners via web-based EDI significantly offers great advantages in the container shipping industry.

Figure 5.2: Number of Business Partners in 2008/ 2009: Adopter vs. Non-Adopter of Web-based EDI



Source: Case Study 2



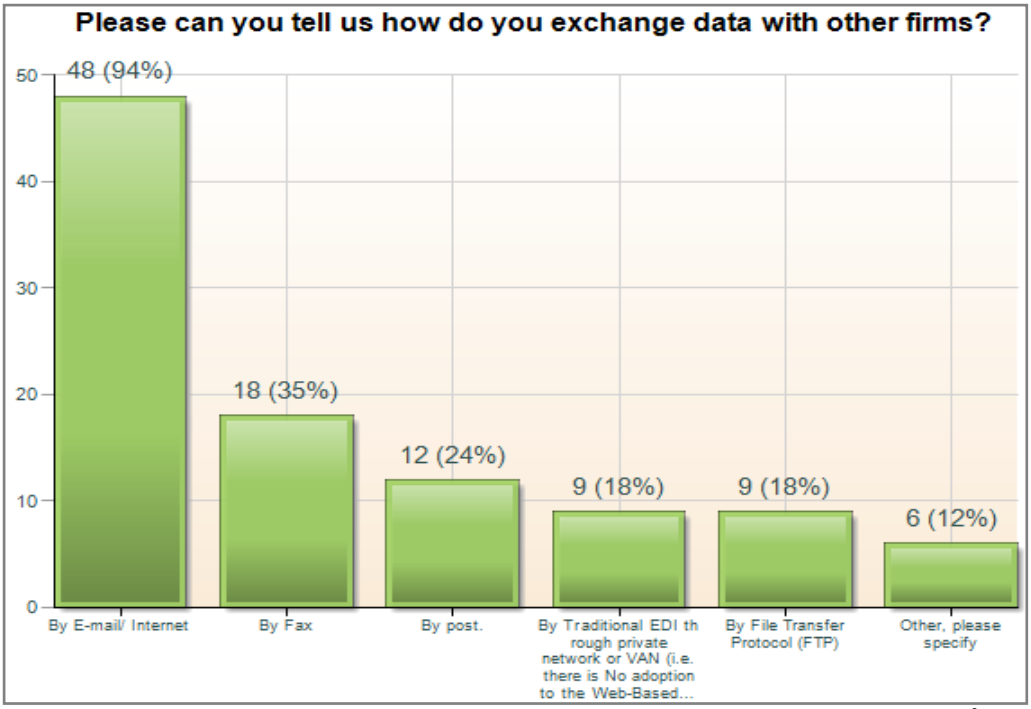
Source: Case Study 2

- **Ways of Exchanging Data with Other Firms**

Figure 5.3 below shows the distribution of the ways of exchanging data with other firms for those have not yet adopted the web-based EDI. Most of the non-web-based EDI adopters (94%) have used E-mail or Internet to exchange data with other firms. 35 % have used fax, 24% by post, 18% by File Transfer Protocol (FTP) and 12% used other source. What is interesting, here, is that, out of 31% of the overall respondents who have not adopted web-based EDI, only 18% of them are using the traditional EDI. Therefore, based on the 164 sample, there is only less than 6% of the respondent, in the global container shipping industry still use traditional EDI.

This result indicates that that web-based EDI is now one major data exchanging approach in the global container shipping industry, and e-mail or internet is the most popular alternative for those non-web-based EDI users, followed by fax, post, traditional EDI and FTP.

Figure 5.3: Ways of Exchanging Data: Frequency of Non-Adopter



Source: Case Study 2

To summaries, Table 5.1 above presents the demographic profile of 164 respondent firms, 69% of them (113 respondents) are web-based EDI adopter and 31% (51 respondents) are non-adopters. The samples were fairly distributed across many areas in terms of firm type, geographic location and service route categories. The responding firms were from broad range of different number of business partners to other measurement, such as TEU per annum.

The large majority respondents were from managerial level (more than 64% of the adopter and 72 % of the non-adopter). Almost half of the respondents' organisations have less than 50 employees. 32.7 percent has 50 to 249 employees, and 20.4 percent have more than 250 employees. The large majority of respondents (65%) have worked more than 5 years in the organisation.

According to our data, it also suggests that web-based EDI is one major data exchanging approach in the global container liner shipping industry; while e-mail or internet is the most popular alternative for those non-web-based EDI users. Web-based EDI adopter also appear to have significant number of business partners, handling more TEU per annum, offer much broader global major service routes than those non-adopters. Furthermore, result shows that container shipping carriers adopted (51.3%) the web-based EDI more than those not adopted (21.6%). However, the shipping agents and freight forwarders appear to be the non-adopters web-based EDI.

5.2 Case Study 2: Analytical Approach

5.2.1 Evaluation of PLS Structural Equation Modelling in Case Study 2

A structural equation modelling (SEM) analysis has been used to test the research hypotheses. Within SEM techniques, two general approaches can be identified. The covariance-based SEM (Joreskog, 1970; Bollen, 1989) is a widely accepted approach, in part due to the development of several computer programs (e.g. LISREL and AMOS) allowing the estimation of this type of model. Conversely, the Partial Least Squares (PLS) approach (Fornell and Cha, 1994; Chin, 1998;; Hulland, 1999) is much less widespread.

It has been mentioned by Chin and Newsted (1999) that both methodologies of causal modelling differ in the statistical assumptions regarding distribution of the observed variables, in the sample size requirements, and in the types of relationship between the observed variables and the associated constructs that can be modelled. The use of covariance-based SEM involves the assumption that the observed variables follow a specific multivariate distribution (normality in the case of Maximum Likelihood, the function typically used for estimating these kinds of models) and requires a sample size which is often beyond the range of researchers, especially if the models to be tested are complex. The alternative methods to the Maximum Likelihood estimation that allow us to work with non-normal data demand even larger samples. Solutions for making model estimation feasible, such as imposing parameter restrictions, disregarding variables in the model, or decreasing the number of indicators for some latent variables, are not advisable (Raykov and Widaman, 1995).

Developed by Wold (1981) to avoid the necessity of large sample sizes and “hard” assumptions of normality, PLS is a second generation modelling technique for estimating path models involving latent constructs indirectly observed by multiple indicators (O’Cass, 2001) that simultaneously assesses the quality of measurement of research constructs (i.e., measurement model) and the interrelationships between the constructs (i.e., structural model). Unlike other SEM techniques, such as LISREL, that use maximum likelihood estimation to gauge the fit between a theoretical model and the covariance matrix of the observed data, PLS assesses the relationships between the research

constructs, and between the constructs and their measurement items, so that the error variance is reduced. Whereas LISREL tests a model and produces fit measures explaining how well the observed data fits the theoretical model, PLS seeks to explain the relationships within a model (Fornell and Bookstein, 1982). PLS assesses the predictive relationships in the model and tests how well one part of the model predicts values in other parts. Therefore, PLS is better for analyses of exploratory models with no or little rigorous theoretical grounding but where explaining the construct interrelationship is desired (Fornell, 1982). Moreover, PLS works under conditions of non-normality and can handle smaller samples. All of these qualities have earned PLS wide acceptance by IS scholars (Chin, 1998; Ranganathan and Sethi, 2002).

In fact, in PLS, measurement and structural parameters are estimated via an iterative procedure which combines simple and multiple regressions by traditional Ordinary Least Squares (OLS), thus avoiding any distributional assumption of the observed variables. Moreover, due to the partial nature of this methodology, where the model parameters are estimated in blocks, the sample size required in PLS is much smaller.

Another important difference between covariance-based SEM and PLS is related to the types of measurement model that can be analysed. The first methodology typically requires that all the constructs are measured through reflective indicators (i.e. the observed variables are influenced or affected by the corresponding underlying latent variable, which accounts for their inter-correlation). A less common measurement perspective is based on the use of formative indicators (Diamantopoulus and Winklhofer, 2001; Jarvis *et al*., 2003). In this situation, the direction of the relationship between the unobserved and the observed variables is the opposite. The indicators cause or form the corresponding construct, which could be viewed as an index rather than a scale. Since traditional SEM attempts to account for all the observed variances and covariance, the use of formative indicators is somewhat problematic (Chin, 1998). Instead, PLS can handle both types of measurement models, reflective and formative (Chin and Newsted, 1999).

Between the two alternative SEM approaches, it was decided to test the research model with structural equation modelling (SEM) using the partial least squares (PLS) technique

(Lohmoeller, 1981; Fornell and Cha, 1994; Wold, 1981). The reason for choosing PLS is mainly because our variables are not normally distributed, also this technique is more robust for small-to-moderate sample sizes such as ours (more well known methods such as LISREL), and because of the formative nature of some of the measures used in this research. Last but not the least, PLS is reported to be more appropriate when the research model is in an early stage of development and has not been tested extensively (Teo *et al.*, 2003). The previous review of EDI adoption literature suggests that empirical tests of guanxi and social network effects are still sparse. Hence, PLS is the appropriate technique for our research purpose.

5.2.2 Measure Validation: Construct Reliability and Validity in Case Study 2

Case Study 2 examines a set of inter-relationships among key factors of web-based EDI. The primary focus was on the strength of the relationships in the model. The sample comprises 113 cases, which is considered adequate for PLS analysis. Therefore, in this research, the PLS approach is preferable because of the suitability of the technique to the nature of this study. PLS provides better prediction capability and it can be used for analysis of a high complexity model with small sample sizes compared to the large number of independent variables and there is no requirement of a normal distribution assumption which suits the nature of the data collected. Hence, PLS was the appropriate analytical technique for the study. The PLS software used in the research is SmartPLS (Version 2.0), which is also widely used in Information System research.

Internal consistency, convergent and discriminant validity of the research instruments were examined to establish the strength of the constructs used in the research model. Internal consistency was examined using composite reliability. The traditional reliability measure of Cronbach's α assumes equal weight for the items measuring the construct and is influenced by the number of items in the construct. In PLS, however, composite reliability relies on actual loadings to compute the factor scores and is therefore a better indicator of internal consistency.

As shown in Table 5.9, the composite reliabilities of each construct in the model were all above the recommended value of 0.8 (Nunnally, 1978), and thus supported the reliability

of the measures. The individual item reliabilities for all measures in constructs were higher than the threshold value of 0.5 (Hair et al. 1992), indicating that each measure had more explanatory power than error.

Table 5.9: Results of Tests on Convergent, Discriminant Validity and Reliability

Construct	Items	Cronbach's Alpha	Composite Reliability	Average variance extracted	Item Reliability	Factors Loading
Trading Partner Power (TPP)		.793	.827	0.834		
	TPP1				.798	.860
	TPP2				.722	.917
	TPP3				.706	.755
Social Network Effect (SNE)		.906	.917	0.922		
	SNE1				845	.775
	SNE2				.882	.844
	SNE3				.895	.787
	SNE4				.847	.842
	SNE5				.883	.833
	SNE6				.875	.836
	SNE7				.804	.668
Trading Partner Dependence (TPD)		.832	.853	0.869		
	TPD1				.758	.733
	TPD2				.769	.820
	TPD3				.772	.859
	TPD4				.765	.849
GuanXi (GX)		.926	.931	0.938		
	GX1				.917	.830
	GX2				914	.913
	GX3				.889	.883
	GX4				.902	.766
	GX5				898	.877
	GX6				.903	.874
Top Management Commitment (TMC)		.914	.926	0.941		
	TMC1				.933	.825
	TMC2				.931	.868
	TMC3				.927	.874
	TMC4				924	.890
	TMC5				.925	.781
	TMC6				.926	.796
Technology Trust(TT)		.957	.966	0.972		
	TT1				.955	.834
	TT2				.949	.907
	TT3				.942	.923
	TT4				.940	.877
	TT5				.944	.871
	TT6				.941	.857
	TT7				.937	.876

	TT8				.939	.877
Trading Partner Trust(TPT)		.964	.968	0.976		
	TPT1				.959	.864
	TPT2				.953	.884
	TPT3				.957	.871
	TPT4				.948	.911
	TPT5				.946	.923
	TPT6				.940	.854
	TPT7				.939	.924
	TPT8				.942	.933
Perceived Interests (PI)		.889	.905	0.916		
	PI1				.878	.822
	PI2				879	.815
	PI3				.887	.891
	PI4				.882	.833
	PI5				.883	.815
Trading Partner e-Readiness (TPE)		.897	.903	0.911		
	TPE1				.898	.815
	TPE2				.893	.869
	TPE3				.882	.906
	TPE4				.891	.906

Source: Case Study 2

Convergent validity of a construct refers to the extent to which two or more attempts to measure the construct are consistent with one another (Cook and Campbell, 1979). Three tests could be used to determine the convergent validity in PLS (Fornell and Larcker, 1981). The results of these tests on the measurement model are shown in Table 5.9. The first was Item Reliability, which examines the factor loading of each item on the variable. Falk and Miller (1992) recommend a loading level of 0.55 to assess item reliability. As can be seen in Table 5.9, all the items had a loading above the suggested threshold, thus providing support for item reliability.

The second test is the composite reliability or internal consistency of each construct, exceeding 0.8. The third test for checking convergent validity is average variance extracted (AVE) by each construct. The AVE for a construct reflects the ratio of the construct's variance to the total amount of variance among the items. Table 5.10 also shows that these constructs also had average variances extracted exceeding 80%, above the limit of 0.50 advised by Fornell and Larcker (1981). In addition, Cronbach's alphas were also used to establish convergent validity of the constructs (higher than 0.8). Thus,

the constructs used in the research model had adequate convergent validity. Hence, the variables in the measurement model demonstrated adequate internal consistency and convergent validity.

Table 5.10: Correlations Matrix & Square Root of Average Variance Extracted of Constructs

	Mean	SD	TPP	SNE	TPD	GX	TMC	TT	TPT	PI	TPeR
TPP	4.29	1.41	**0.834**								
SNE	5.26	1.00	0.286**	**0.922**							
TPD	5.35	1.10	0.302**	0.323**	**0.869**						
GX	4.78	1.23	0.246**	0.236**	0.385**	**0.938**					
TMC	5.60	1.00	0.248*	0.314**	0.374**	0.204*	**0.941**				
TT	5.59	0.93	0.223*	0.406**	0.539**	0.257**	0.274**	**0.972**			
TPT	5.32	0.98	0.427**	0.395**	0.426**	0.256**	0.203**	0.267**	**0.976**		
PI	5.98	0.95	0.258*	0.286**	0.331**	0.325**	0.424**	0.254**	0.248**	**0.916**	.*
TPeR	4.85	1.15	0.359**	0.447**	0.497**	0.357**	0.322**	0.369**	0.274**	0.266**	**0.911**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

TPP = Trading Partner Power; SNE = Social Network Effect; TPD= Trading Partner Dependence; GX = Guaxi; TMC = Top Management Commitment; TT= Technological Trust; TPT = Trading Partner Power; PI = Perceived Interests; TPeR = Trading Partner eReadiness.

Source: Case Study 2

Furthermore, two tests were used to evaluate discriminant validity at both the item and construct levels. First, according to Barclay et al. (1995), no item should load more highly on another construct than it does on the one it is intended to measure. Thus, by calculating the cross-loadings, it has been verified that each item loads more on the construct it intends to measure than any other construct, and that each latent variable relates more to its own manifest variables than to the indicators of other constructs (see Table 5.9). Secondly, discriminant validity refers to the extent to which measures of each construct are distinct from one another (Campbell and Fiske, 1959). This is determined by ensuring that the average variance extracted for each construct is greater than the squared correlations between constructs (Fornell and Larcker 1981). These statistics are shown in Table 5.10. Results show that the square root of its AVE is greater than its correlation with any other construct and this condition is met in all the cases, meaning it

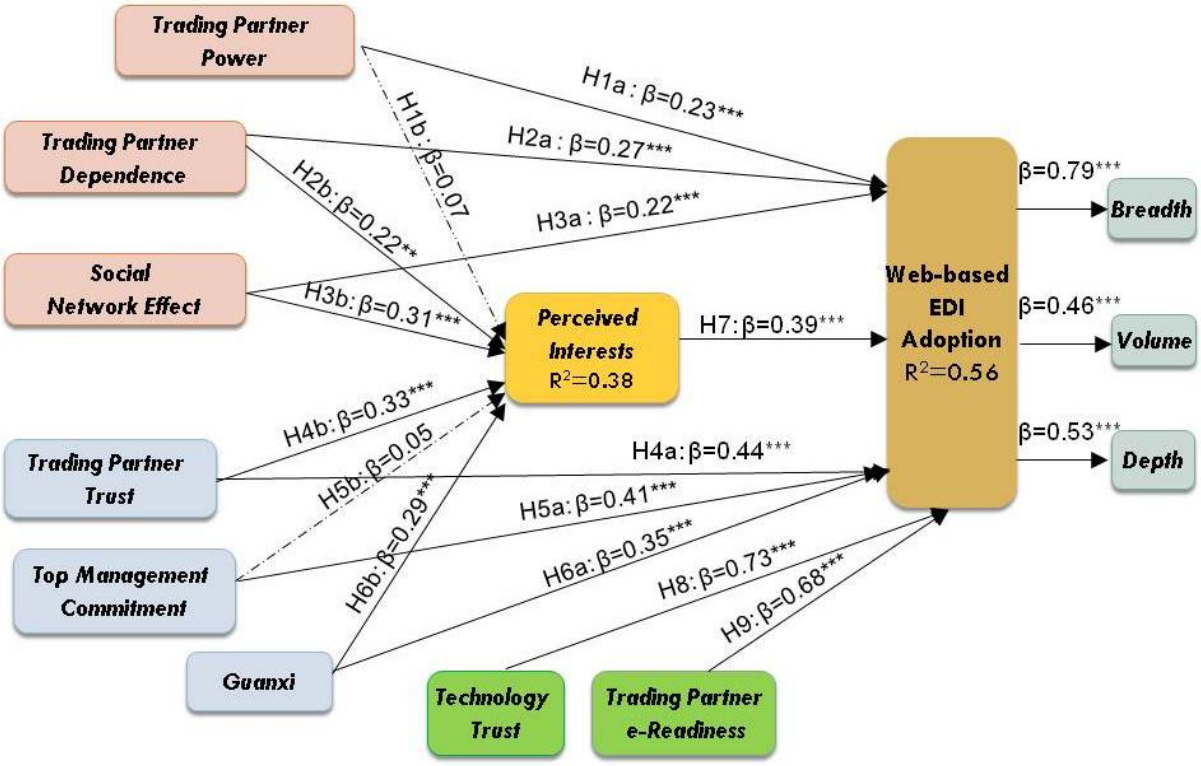
shares more variance with its own measures than with other constructs in the model. Hence, this result indicates that there is satisfactory discriminant validity among the construct measures of the research model. In addition, the content validity of the measures was assessed by pre-test with knowledgeable experts.

5.2.3 Case Study 2: Hypothesis Testing

Similarly, Partial least squares (PLS) software (SmartPLS version 2.0) was used to test the hypothesised research model linking *perceived interests*, Social Resources (*trading partner power*, *trading partner dependence*, and *social network effect*), Relational Resources (*trading partner trust*, *top management commitment* and *guanxi*), Technology State (*technology trust* and *trading partner e-readiness*) and the web-based EDI adoption (through three inter-related dimensions: *breadth*, *volume*, and *depth*).

The structural equation model was assessed by estimating the path loadings and the R^2 values. Path loadings indicate the strengths of the relationships between the independent variables and dependent variable. Interpreted like multiple regression results, R^2 values indicate the amount of variance explained by the exogenous variables and measure the predictive power of the structural models. The results of our hypotheses testing are presented in Figure 5.4. It shows the results of the PLS analysis performed to test the structural model. In particular, the standardised path coefficients (β), the significance level (t statistic) and the value of the R^2 of the major dependent variables are shown. All the hypotheses are supported, with the exception of H2b, H6b, were found to be significant at 0.01 level. The construct of perceived interests explains 38% of variation by both Social and Relational Resources derived from social exchange theory. The construct of web-based EDI adoption explains 56% of the variables for the rest of nine constructs. Overall, the results indicate a strong support for the model. The assessment of the measurement and structural models indicates that the results of the PLS model are acceptable.

Figure 5.4: Case Study 2: Results of PLS Model on Web-based EDI Adoption



Source: Case Study 2

As indicated by path loadings, all the nine constructs (*trading partner power*, *trading partner dependence*, *social network effect*, *trading partner trust*, *top management commitment*, *guanxi*, *perceived interests*, *technology trust*, and *trading partner e-readiness*) had significant positive influences on web-based EDI adoption (β= *0*.23, 0.27, 0.22, 0.44, 0.41, 0.35, 0.39, 0.73 and 0.68, respectively; *p<0.001*). This result confirmed our theoretical expectation and provided support for H1a, H2a, H3a, H4a, H5a, H6a H7, H8, and H9.

Of the three hypotheses (H1b, H2b, H3b) considering the links between *perceived interests* and the Social Resources, only *trading partner dependence* (β=*0.22, p <0.001*), *social network effect* (β=*0.31, p <0.001*)) are supported. H1b was rejected, as there is no significant loading from *trading partner power* (β=*0.07, p =1.19*).

Of the three hypotheses about the *perceived interests* and the Relational Resources (*trading partner trust*, *top management commitment*, *guanxi)* – H4b, H5b, H6b – only H4b,

H6b, which deals with *trading partner trust* (β=0.33, *p<0.001*) and *guanxi* (β=0.29, *p<0.001*) respectively, has been confirmed. However, H5b was rejected. We have not found a significant positive relationship (β=*0.05, p =0.09*) between *top management commitment* and *perceived interests*, despite some academic research defending its existence. Tale 5.11 below summaries the results of the hypothesis testing.

Table 5.11: Case Study 2: Summary of Hypothesis Testing

	Path				
	Independent	Dependent	Beta	Significance Level	Outcomes
H1a	TPP	WEDI	0.23	p<0.01	Supported
H2a	TPD	WEDI	0.27	p<0.01	Supported
H3a	SNE	WEDI	0.22	p<0.01	Supported
H4a	TPT	WEDI	0.44	p<0.01	Supported
H5a	TMC	WEDI	0.41	p<0.01	Supported
H6a	GX	WEDI	0.35	p<0.01	Supported
H7	PI	WEDI	0.39	p<0.01	Supported
H8	TT	WEDI	0.73	p<0.01	Supported
H9	TPeR	WEDI	0.68	p<0.01	Supported
H1b	TPP	PI	0.07	p=0.17	Not Supported
H2b	TPD	PI	0.22	p<0.01	Supported
H3b	SNE	PI	0.31	p<0.01	Supported
H4b	TPT	PI	0.33	p<0.01	Supported
H5b	TMC	PI	0.05	p=0.09	Not Supported
H6b	GX	PI	0.29	p<0.01	Supported
-	WEDI	Breadth	0.79	p<0.01	Supported
-	WEDI	Volume	0.46	p<0.01	Supported
-	WEDI	Depth	0.53	p<0.01	Supported

Source: Case Study 2

5.3 Case Study 3 - April 2012

After the Case Study 1 and the Case Study 2 launched in late 2008/2009 over the top 20 global container liners through the quantitative approach of E-mail and Web survey via E-mail Extractor, E-mail Verifier and Zoomerang, a further Case Study 3 has been done in 2012 to further improve the current understanding of those social and relational aspects of web-based EDI adoption factors. This Case Study 3 would also update the latest industrial data on the use of web-based EDI and to further test verify the research model and the associated nine constructs. It would be also interesting to investigate the

relationships of the nine constructs regarding to their impact to the adoption of web-based EDI.

Based on UNCTAD's list of the top 20 container carriers (See Table 5.12), the sampling frame was assembled from the latest *Review of Maritime Transport*, 2011 (RMT), one of United Nations Conference on Trade And Development's (UNCTAD) flagship publications, published annually regarding on the worldwide evolution of container shipping industry. Based on the number of ships and total shipboard capacity deployed (TEUs), this list included the ranking of the top 20 container shipping liners, accounted for about 70 per cent of the total global container capacity deployed (UNCTAD secretariat, 2011, p45). Therefore, these twenty liners were chosen to be the targeted firms in this Case Study 3, representing the global container liner shipping industry.

Table 5.12: Twenty Leading Service Operators of Containership in 2011 (Number of ships and total shipboard capacity deployed (TEUs))

Ranking	Operator	Country/territory	Number of vessels	Average vessel size	TEU
1	Maersk Line	Denmark	414	4 398	1 820 816
2	MSC	Switzerland	422	4 176	1 762 169
3	CMA CGM Group	France	288	3 715	1 069 847
4	Evergreen Line	China, Taiwan Province of	162	3 666	593 829
5	APL	Singapore	141	4 197	591 736
6	COSCON	China	147	3 848	565 728
7	Hapag-Lloyd Group	Germany	126	4 446	560 197
8	CSCL	China	120	3 841	460 906
9	Hanjin	Republic of Korea	98	4 565	447 332
10	CSAV	Chile	119	3 217	382 786
11	OOCL	China, Hong Kong SAR	85	4 408	374 714
12	MOL	Japan	91	3 989	362 998
13	NYK	Japan	85	4 152	352 915
14	K Line	Japan	84	4 143	347 989
15	Hamburg Sud	Germany	98	3 423	335 449
16	Yang Ming	China, Taiwan Province of	78	4 137	322 723
17	HMM	Republic of Korea	60	4 753	285 183
18	Zim	Israel	73	3 857	281 532
19	PIL	Singapore	111	2 146	238 241
20	UASC	Kuwait	47	3 800	178 599
Total top 20 carriers			2 849	3 979	11 335 689
Others			6 839	719	4 918 299
World containership fleet			9 688	1 678	16 253 988

Source: UNCTAD secretariat, Containerisation International Inline, Fleet Statistics, www.ci-online.co.uk

The Case Study 3 was launched during the period of April to 15th of June 2012, targeting the top 20 global container liner shipping companies on the use of web-based EDI through the online survey approach via Zoomerang.

In this Case Study 3, same data collection method used in the Case Study 2 was followed to keep the condition the same. The survey instrument went through four phases of extensive pretesting before administration. First, based on the item developed from the Case Study 2, the instrument was reviewed by faculty for comprehensiveness, clearness and coherence. Second, designed to collect the contacts of businesses from web pages on the Internet, Lencom's Fast E-mail Extractor (FEE), was used to effectively scans the websites and extract the relevant e-mails directly from each of the selected container liner's company website. This approach provides the comprehensive ability to extract information from several known websites that have e-mail ids embedded. Several inappropriate/irrelevant websites were manually removed from further scanning. Thirdly, after using the FEE, the results were saved in excel format and were edited, sorted and exported to the Fast E-mail Verifier (FEV), which connects directly to the SMTP server, to verify, validate, and remove duplicated e-mail addresses for checking the quality of e-mail addresses without disturbing anyone to make sure our email addresses and domains are valid.

Out of the 3,985 valid and unique e-mail addresses gathered FEE and verified by FEV, similar to the Case Study 2, the stratified random sampling method was adopted to identify the 2,000 respondents as the sample in this Case Study 3. Finally, the survey was executed by Zoomerang online survey tool, sending e-mails to the 2,000 samples. However, out of the 2,000 samples, 388 of them have chosen to be opted-out and 547 of them were bounced back for some unknown reasons. This leaves it an effective sample of 1,065. Ideally, eligible respondents are those executives or managers best qualified to speak about the firm's overall computing activities. For medium or large firms, the respondent is hope to reach vice president or a senior manager with information system related responsibilities; CEO, president or managing director for small firms. It is believed that the sample size, though not large, is significant since it specifically targeted and

reached knowledgeable users of information technology in these companies.

The invitees were informed that the goal of the survey was to explore and understand factors that affect adoption of web-based EDI in the global container shipping industry, and they were assured that the results would be reported in aggregate to guarantee their anonymity. Given the study's need to assess collective organisational perceptions, the key respondents were asked to evaluate the perceptions of the entire group of people responsible for their firm's experiences in web-based EDI adoption. To motivate organisations to respond, the respondents were offered a report that summarised the results of the survey and compared their company against other firms. The initial mailing received 168 usable responses. One follow up e-mail reminder was sent to each of those non-responding samples three week after the initial mailing and an additional 27 usable responses were returned.

Therefore, in this Case Study 3, out of the 2,000 samples, 388 opted-out, 547 undeliverable, resulting an effective sample of 1,065. Over the 2-month data collection period, 789 people opened the Zoomerang online survey, consists of 278 partial attempted questionnaires and 195 completed questionnaires. Out of these 195 unique and valid responses, 158 (81%) of them adopted web-based EDI in their business activity, the rest 37 (19%) respondent firms did not; resulting in an effective response rate of 18.3%, which is comparable to similar studies (Ranganathan *et al*., 2004; Soliman and Janz, 2004). In general, response rates greater than 20% are recommended in supply chain management research (Prahinski and Benton, 2004; Pagell *et al.*, 2004). However, this sample size met the level of 100 and above that Hair *et al.* (1992) recommended for providing valid results.

Response bias is always a concern in survey research, especially when the response rate is low (Ranganathan *et al.*, 2004). To check if there were non-respondents bias, the data was checked by comparing early and late respondents firms on all the key research constructs in the model. The t-test revealed no significant differences emerged in the mean responses on any of the constructs. Lastly, on the assumption that a significant correlation between items scores and survey response time would indicate response bias,

all the correlation between the mean scores of the research construct and response time were examined, and none were significant. Early respondents were identified by selecting those that responded during the first week (86%), against those responding later (14%). These tests were based on sample characteristics – (a) annual handling amount of TEU, (b) number of employees, and (c) geographic location, and the actual scale responses. Both tests showed no significant differences for these three characteristics at the $p<0.1$ level; therefore, the risk of non-response bias to the internal validity of this study's results is limited. Together, these results suggest that non-response bias were not a major problem, and that our sample can be considered as fairly representative of the population.

We tested non-response bias and no statistically significant differences were found. We also examined the so-called “common method bias” which can potentially occur in survey data (Podsakoff *et al.*, 2003). The results of Harman’s single-factor test (Podsakoff *et al.,* 2003) suggest no significant common method bias in our 2012 dataset.

5.3.1 Descriptive Statistics in Case Study 3

A summary of the demographic characteristics of the 195 sample in the Case Study 3 of 2012 is presented in Table 5.13. Regarding to the job title, out of the 195 respondent, 57% of the respondents were classified by title as either 'manager/assistant manager', 'director or vice director' or 'vice president or above'. The high percentage response from managers or above reflects the reliability of this research. In order to understand how well the respondents actually understand or able to represent the company's view on participating in web-based EDI systems, respondents were asked to indicate their length working in the organisation. 70% of the overall respondents have worked more than 5 years, which suggests that respondents have abundant experiences to represent the shipping liner in reflecting the company's relative importance in the process EDI adoption.

Table 5.13: Case Study 3: Demographic Profile of Respondents

	Frequency and (%)		Frequency and (%)
Job Title		**Type of the Firm**	
Vice Present or above	15 (8%)	Container Shipping Carrier	121 (62%)
Director or Vice Director	38 (19%)	Shipping Agent	29 (15%)
Manager or Assistant Manager	59 (30%)	Freight Forwarder	22 (11%)
Information System Staff	35 (18%)	Terminal Operator	7 (4%)
Operational Staff	15 (8%)	Inter-model Operators	4 (2%)
Marketing/ Sales Representative	28(14%)	Importer or Exporter	2 (1%)
Other	5 (3%)	Others	10 (5%)
Total	195 (100%)	**Total**	195 (100%)
Years of Working Experiences		**Geographic Location of the Firm**	
1 or below	15 (8%)	Asia - East (China, Pacific OECD Asia)	43 (22%)
1 ~ 5	43 (22%)	Asia - West (Central, Middle East & South Asia)	33 (17%)
6 ~ 10	47 (24%)	Europe / Africa	49 (25%)
11 ~ 15	27 (14%)	North America	51 (26%)
16 ~ 20	28 (14%)	Latin America	19 (10%)
20 or above	35 (18%)	**Total**	195 (100%)
Total	195	**Service Routes**	
Firm Size (Number of Employees)		Fast East / Europe	121 (62%)
Small (Up to 49 employees)	49 (25%)	Inter-Asia	92 (47%)
Medium (Between 50 & 249 employees)	64 (33%)	America/ Europe	104 (53%)
Large (More than 250 employees)	82 (42%)	Fast East / America	96 (49%)
Total	195	Others	67 (34%)

Source: Case Study 3

- **Firm Size**

Of the 195 responses received, 75% of the respondent are coming from either medium/ large firm size. For those adopted the web-based EDI, Table 5.14 shows that only one quarter of the firms are small-size firm; while 35.9% of them belong to the large-firm category, and the majority of the medium-size firms (38.6%) indicated they have adopted web-based EDI. On the other hand, the data suggests that only 9.5% of small firms and 28.6% of medium firms have not yet adopted the web-based EDI (See Table 5.14). The majority (61.9%) of the large firms chose not to adopt web-based EDI. This shows that although large size company has the highest rate of choosing not to adopt web-based EDI, there are more large-size and medium-size firms begin to adopt web-based EDI compare with my previous study.

Table 5.14: Case Study 3: Firm Size:
Adopter vs. Non-Adopter of Web-based EDI

Does your org use Web-based EDI?		Frequency	Percent
Yes	Small (Up to 49 employees)	39	25.5%
	Medium (Between 50 and 249 employees)	59	38.6%
	Large (More than 250 employees)	55	35.9%
	Total	153	100.0%
No	Small (Up to 49 employees)	4	9.5%
	Medium (Between 50 and 249 employees)	12	28.6%
	Large (More than 250 employees)	26	61.9%
	Total	42	100.0%
Overall	Total	195	100

Source: Case Study 3

- **Primary Business Activity**

To gather the information regarding to what types of the organisation are coming from, respondents were asked about the organisation's primary business activity. Out of the 195 responses, Table 5.13 shows the majority (62%) of respondents are from container shipping liners. Secondly, 15% of respondents are from shipping agents; 11% are from freight forwarders; 4% are from the Terminal operators; only 2 % each is from Inter-modal operator and shipper. Generally speaking, this result indicates the validity of the sample since the survey have reached to the targeted group within the liner shipping industry.

By comparing with the data between the adopter and the non-adopter, Table 5.15 shows that the majority (69.3) of Container Shipping Carriers have adopted Web-based EDI. However, when looking into the non-adopters, half of the Container Shipping Carrier type of firms have not yet adopted Web-based EDI – the highest group which adopt Web-based EDI as well as not adopt Web-based EDI according to this survey.

Table 5.15: Primary Business Activity:
Adopter vs. Non-Adopter of Web-based EDI

Does your org use Web-based EDI?		Frequency	Percent	Cumulative Percent
Yes	Container Shipping Carrier	106	69.5	69.3
	Freight Forwarder	13	8.5	78.0
	Terminal Operator	4	2.6	80.6
	Inter- modal Operators	3	1.9	82.5
	Shipping Agent	26	16.9	99.4
	Others	1	0.6	100.0
	Total	153	100.0	
No	Container Shipping Carrier	21	50.0	50.0
	Freight Forwarder	11	26.2	76.2
	Terminal Operator	2	4.8	81.0
	Shipping Agent	4	9.5	90.5
	Shipper / Importer / Exporter	3	7.1	97.6
	Others	1	2.4	100.0
	Total	42	100.0	
Overall	Total	195	100.0	

Source: Case Study 3

- **Geographic Location of the Firm**

Overall, Table 5.13 above shows that 39% of respondents are from the region of Asia where 22% of them are from 'Asia-East' and 17% are from 'Asia-West.' 25% are classified location as 'Europe/Africa.' 36% of respondents are from the region of America where the majority are from 'North America' (26%) and only 10% are from 'Latin America'.

Moreover, Table 5.16 below shows a mixture firm's geographic location. Companies from North America (36%), Europe (30.7%) and East Asia (23.5%) tend to adopt Web-based EDI. On the other hand, East Asia (35.7%) and West Asia (21.4%) have the least adoption rate. Nevertheless, the overall result shows a good mix of sources in terms of the geographic

location of the firms. This distinction is important as it offers the global characteristics of the container shipping liner industry in web-based EDI adoption as well as its reliability.

Table 5.16: Case Study 3: Geographic Location of the Firm:

Adopter vs. Non-Adopter of Web-based EDI

Does your org use Web-based EDI?		Frequency	Percent	Cumulative Percent
Yes	Europe / Africa	47	30.7	30.7
	Asia - East (China & CPA, Pacific Asia & Pacific OECD)	36	23.5	54.2
	Asia - West (Central Asia, Middle East & South Asia)	9	5.9	60.1
	Latin America	6	3.9	64.0
	North America	55	36.0	100.0
	Total	153	100.0	
No	Europe / Africa	8	19.1	19.1
	Asia - East (China & CPA, Pacific Asia & Pacific OECD)	15	35.7	54.8
	Asia - West (Central Asia, Middle East & South Asia)	9	21.4	76.2
	Latin America	4	9.5	85.7
	North America	6	14.3	100.0
	Total	42	100.0	
Overall	Total	195	100.0	

Source: Case Study 3

- **Service Routes**

Within this Case Study 3 that out of the 153 web-based EDI organisations, Far East/ Europe route is the most common service route they have been involved with at 62%; while 47% of the firms involved in inter-Asia route, 53% of the firms involved in America/ Europe service route, 49% of the firms involved in Far East/ America service route, and only 34% of the firms indicate they also operate in some other service routes. The result of the coverage of the container shipping service routes suggests that Case Study 3 has been covered good portion of the container shipping industry in terms of the service routes firm provided. More importantly (see Table 5.17), Case Study 3 also shows that for those adopted, firms (around 70%) adopted the web-based ED are able to offer more of its service coverage than those have not adopted (around 50%), despite the non-adopters offer more proportion in the 'Other Service Routes' category (19% compare with 17% of adopters).

Table 5.17: Case Study 3: Service Routes:
Adopter vs. Non-Adopter of Web-based EDI

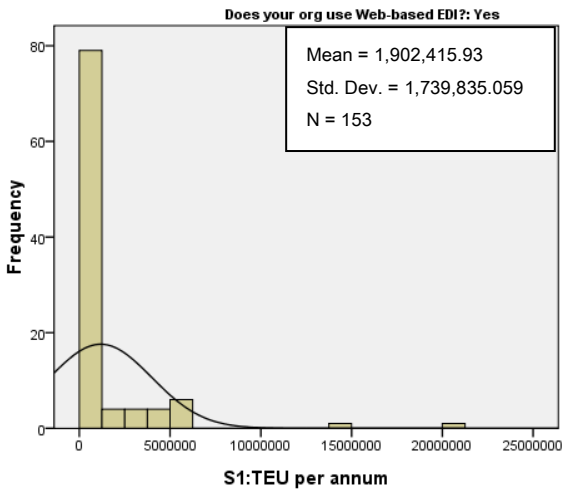
			Service Routes				
Does your org use Web-based EDI?			Far East / America	Inter-Asia	Far East / Europe	America / Europe	Other Service Routes
Yes	153	Frequency	108	98	104	112	26
		Percentage	70.6%	64.1%	68.0%	73.2%	17.0%
No	42	Frequency	21	23	20	18	8
		Percentage	50.0%	54.8%	47.6%	42.9%	19.0.%

Source: Case Study 3

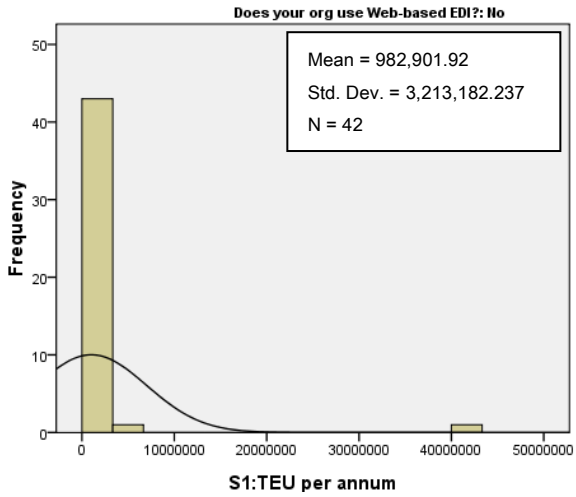
- **TEU per Annum**

In order to compare the influence of the web-based EDI adoption in the container shipping industry, the twenty-foot equivalent unit (TEU) per annum over an annual handling amount was brought into the measurement. Figure 5.5 shows the frequency distribution of for both adopter and non-adopter of web-based EDI. According to this survey based on 99 adopters and the 45 non-adopters, the web-based EDI adopter, in average, can handle 919,514 (around 48%) more TEU per year than those non-adopters. Despite some of the data were unavailable, the outcome of the result certainly indicates the competitive advantage of using web-based EDI in the liner shipping industry.

Figure 5.5: 2012: TUE per Annum:
Adopter vs. Non-Adopter of Web-based EDI



Source: Case Study 3



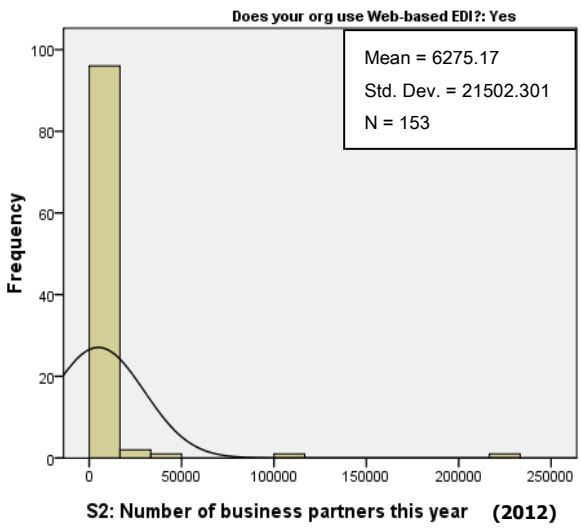
Source: Case Study 3

- **Number of Business Partners this year (2012)**

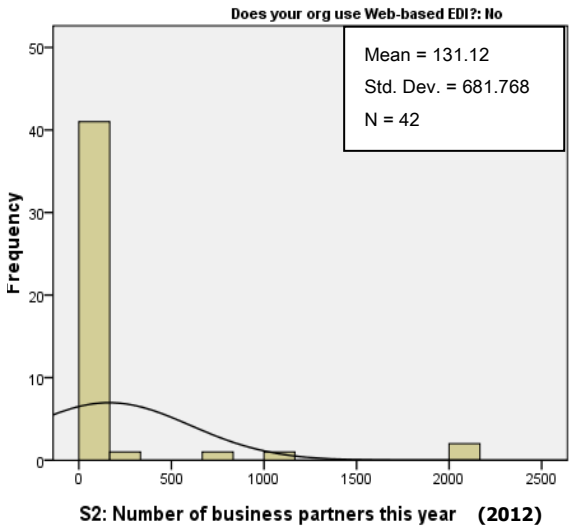
In Case Study 3, it also compares the number of business partners between the adopters and non-adopters. Figure 5.6 shows that based on the 153 adopters and 42 non-adopters, web-based EDI adopters on average has 6,275 business partners over the year 2011, compared with only 131 business partners for the non-web-based EDI adopter.

Similar to the Case Study 2, the result shows web-based EDI adopters have the ability to effectively connect much more business partners than non-adopters, offering very significant advantages in connecting more business partners in the global container shipping industry.

Figure 5.6: 2012: Number of Business Partners: Adopter vs. Non-Adopter of Web-based EDI



Source: Case Study 3



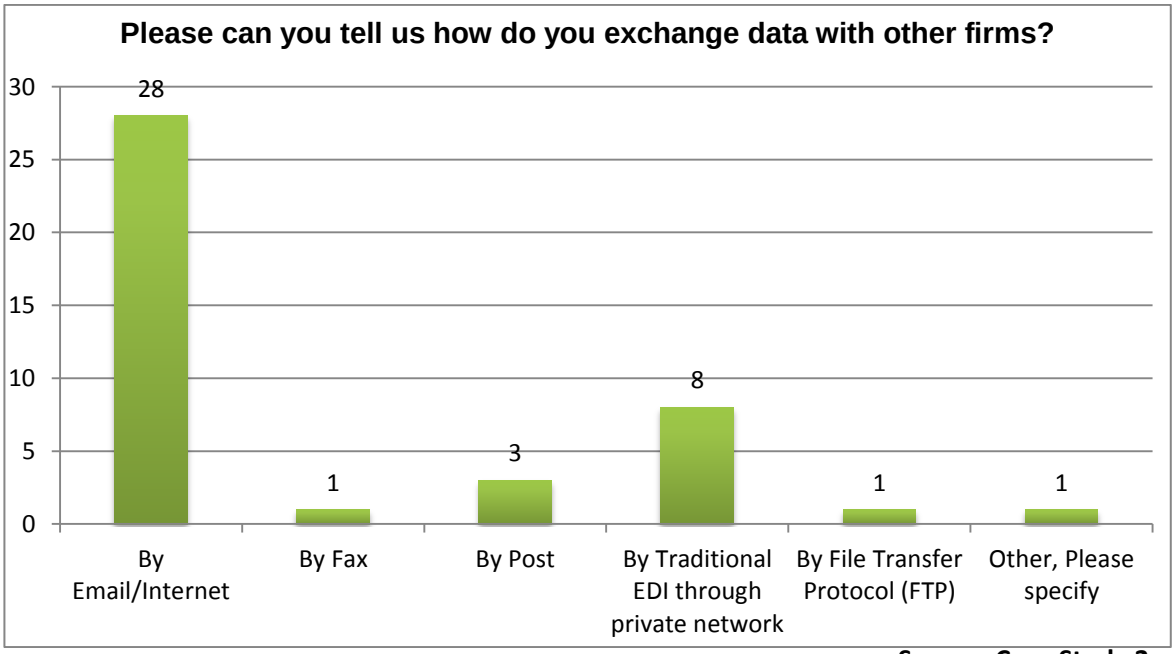
Source: Case Study 3

- **Ways of Exchanging Data with Other Firms**

Figure 5.7 below shows the distribution of the ways of exchanging data with other firms for those have not yet adopted the web-based EDI. Most of the non-web-based EDI adopters (67%) have used E-mail or Internet to exchange data with other firms. 2 % have used fax, 7% by post, 2% by File Transfer Protocol (FTP) and 2% used other source. What is interesting here, is that, out of 27% of the overall respondents who have not adopted web-based EDI, only 19% of them are using the traditional EDI.

Overall, according to the 195 respondents in this third case study, only 4% of the company in the global container shipping industry still use traditional EDI. This result further confirms that web-based EDI is now one major data exchanging approach in the global container shipping industry, and e-mail or internet is the most popular alternative for those non-web-based EDI users, followed by fax, post, traditional EDI and FTP. This result shows similar pattern to the Case Study 2.

Figure 5.7: 2012: Ways of Exchanging Data: Frequency of Non-Adopter



Source: Case Study 3

To summaries, Table 5.13 above presents the demographic profile of 195 respondent firms, 78% of them (153 respondents) are WEDI adopter and 22% (42 respondents) are non-adopters. The samples were fairly distributed across many areas in terms of firm type, geographic location and service route categories. The responding firms were from broad range of different number of business partners to other measurement, such as TEU per annum.

The large majority respondents were from managerial level (more than 57% of the adopter and 72 % of the non-adopter). Only a quarter of the respondents' organisations are from small-sized company, 33 % from medium-sized company and 42% are from large-size company. The large majority of respondents (70%) have worked more than 5 years in the organisation. This shows the data were collected from experienced respondent, and the sample are mostly from large-size company. Compare this with my previous Case Study 2; it appears that the large-size company adopt WEDI more than medium-size firms or the small-size company; where previously more WEDI adoption was adopted by small-size company.

According to this Case Study 3, it confirms that web-based EDI is the major data exchanging method in the global container liner shipping industry; while e-mail or internet is the most popular alternative for those non-web-based EDI users. Web-based EDI adopter also appear to have significant number of business partners, handling more TEU per annum, offer much broader global major service routes than those non-adopters.

Furthermore, result shows that container-shipping carriers adopted (62%) the web-based EDI more than those not adopted (22%). However, the shipping agents and freight forwarders appear to be the non-adopters of web-based EDI

5.3.2 Construct Reliability and Validity in Case Study 3

In order to construct the reliability and validity of the 195 data set collected for Case Study 3, the PLS approach is adopted. It is considered to an appropriate analytical technique for this third case study that has a relative small sample size. In addition, PLS is generally regarded to have a better predictive capability for analysis of a high complexity

model with small sample sizes compared to the large number of independent variables without the requirement of a normal distribution assumption which suits the nature of the data collected. Hence, PLS is chosen to be used for this third case study by using SmartPLS (Version 2.0), similar to what was used in the Case Study 2.

This Case Study 3 examines a set of inter-relationships among key factors of web-based EDI. The primary focus was on the strength of the relationships in the model. Internal consistency, convergent and discriminant validity of the research instruments were examined to establish the strength of the constructs used in the research model. Internal consistency was examined using composite reliability. The traditional reliability measure of Cronbach's α assumes equal weight for the items measuring the construct and is influenced by the number of items in the construct. In PLS, however, composite reliability relies on actual loadings to compute the factor scores and is therefore a better indicator of internal consistency.

As shown in Table 5.18, the composite reliabilities of each construct in the model were all above the recommended value of 0.8 (Nunnally, 1978), and thus supported the reliability of the measures. The individual item reliabilities for all measures in constructs were higher than the threshold value of 0.5 (Hair et al. 1992), indicating that each measure had more explanatory power than error.

Table 5.18: Case Study 3: Results of Tests on Convergent, Discriminant Validity and Reliability

Construct	Items	Cronbach's Alpha	Composite Reliability	Average variance extracted	Item Reliability	Factors Loading
Trading Partner Power (TPP)		.821	.852	0.834		
	TPP1				.829	.854
	TPP2				.803	.897
	TPP3				.816	.825
Social Network Effect (SNE)		.867	.821	0.881		
	SNE1				852	.798
	SNE2				.863	.834
	SNE3				.871	.817
	SNE4				.857	.822
	SNE5				.891	.863
	SNE6				.854	.844
	SNE7				.824	.747

Trading Partner Dependence (TPD)		.869	.843	0.869		
	TPD1				.791	.763
	TPD2				.783	.807
	TPD3				.793	.816
	TPD4				.772	.815
Guanxi (GX)		.826	.871	0.892		
	GX1				.904	.870
	GX2				917	.901
	GX3				.898	.858
	GX4				.922	.896
	GX5				906	.882
	GX6				.911	.893
Top Management Commitment (TMC)		.815	.802	0.827		
	TMC1				.823	.846
	TMC2				.818	.828
	TMC3				.813	.804
	TMC4				806	.810
	TMC5				.825	.782
	TMC6				.824	.786
Technology Trust(TT)		.906	.943	0.925		
	TT1				.905	.874
	TT2				.919	.909
	TT3				.912	.903
	TT4				.920	.927
	TT5				.914	.901
	TT6				.921	.917
	TT7				.921	.906
	TT8				.909	.887
Trading Partner Trust(TPT)		.924	.917	0.946		
	TPT1				.929	.894
	TPT2				.953	.916
	TPT3				.937	.897
	TPT4				.933	.921
	TPT5				.916	.903
	TPT6				.923	.898
	TPT7				.909	.914
	TPT8				.912	.907
Perceived Interests (PI)		.872	.929	0.909		
	PI1				.898	.852
	PI2				879	.885
	PI3				.884	.841
	PI4				.882	.863
	PI5				.873	.859
Trading Partner e-Readiness (TPE)		.891	.917	0.903		
	TPE1				.898	.865
	TPE2				.893	.884
	TPE3				.876	.836
	TPE4				.882	.873

Source: Case Study 3

Convergent validity of a construct refers to the extent to which two or more attempts to measure the construct are consistent with one another (Cook and Campbell, 1979). Three tests could be used to determine the convergent validity in PLS (Fornell and Larcker, 1981). The results of these tests on the measurement model are shown in Table 5.18. The first was Item Reliability, which examines the factor loading of each item on the variable. Falk and Miller (1992) recommend a loading level of 0.55 to assess item reliability. As can be seen in Table 5.18, all the items had a loading above the suggested threshold, thus providing support for item reliability.

The second test is the composite reliability or internal consistency of each construct, exceeding 0.8. The third test for checking convergent validity is average variance extracted (AVE) by each construct. The AVE for a construct reflects the ratio of the construct's variance to the total amount of variance among the items. Table 5.19 also shows that these constructs also had average variances extracted exceeding 80%, above the limit of 0.50 advised by Fornell and Larcker (1981). In addition, Cronbach's alphas were also used to establish convergent validity of the constructs (higher than 0.8). Thus, the constructs used in the research model had adequate convergent validity. Hence, the variables in the measurement model demonstrated adequate internal consistency and convergent validity.

Table 5.19: Case Study 3: Correlations Matrix & Square Root of Average Variance Extracted of Constructs

	Mean	SD	TPP	SNE	TPD	GX	TMC	TT	TPT	PI	TPeR
TPP	4.57	1.21	**0.856**								
SNE	5.18	0.90	0.264**	**0.907**							
TPD	5.35	0.95	0.282**	0.293**	**0.894**						
GX	4.68	1.17	0.265**	0.261**	0.351**	**0.912**					
TMC	5.03	0.82	0.258*	0.311**	0.324**	0.249*	**0.881**				
TT	5.84	0.93	0.239*	0.306**	0.391**	0.272**	0.234**	**0.928**			
TPT	5.62	0.85	0.378**	0.357**	0.407**	0.234**	0.236**	0.278**	**0.941**		
PI	5.91	0.88	0.358*	0.316**	0.318**	0.351**	0.314**	0.249**	0.288**	**0.932**	.*
TPeR	4.95	1.35	0.251**	0.247**	0.377**	0.307**	0.307**	0.339**	0.241**	0.284**	**0.899**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

TPP = Trading Partner Power; SNE = Social Network Effect; TPD= Trading Partner Dependence; GX = Guaxi; TMC = Top Management Commitment; TT= Technological Trust; TPT = Trading Partner Power; PI = Perceived Interests; TPeR = Trading Partner eReadiness.

Source: Case Study 3

Furthermore, two tests were used to evaluate discriminant validity at both the item and construct levels. First, according to Barclay et al. (1995), no item should load more highly on another construct than it does on the one it is intended to measure. Thus, by calculating the cross-loadings, it has been verified that each item loads more on the construct it intends to measure than any other construct, and that each latent variable relates more to its own manifest variables than to the indicators of other constructs (see Table 5.18). Secondly, discriminant validity refers to the extent to which measures of each construct are distinct from one another (Campbell and Fiske, 1959). This is determined by ensuring that the average variance extracted for each construct is greater than the squared correlations between constructs (Fornell and Larcker, 1981). These statistics are shown in Table 5.19. Results show that the square root of its AVE is greater than its correlation with any other construct and this condition is met in all the cases, meaning it shares more variance with its own measures than with other constructs in the model. Hence, this result indicates that there is satisfactory discriminant validity among the construct measures of the research model. Also, the content validity of the measures was assessed by pre-test with knowledgeable experts.

5.3.3 Case Study 3: Hypothesis Testing

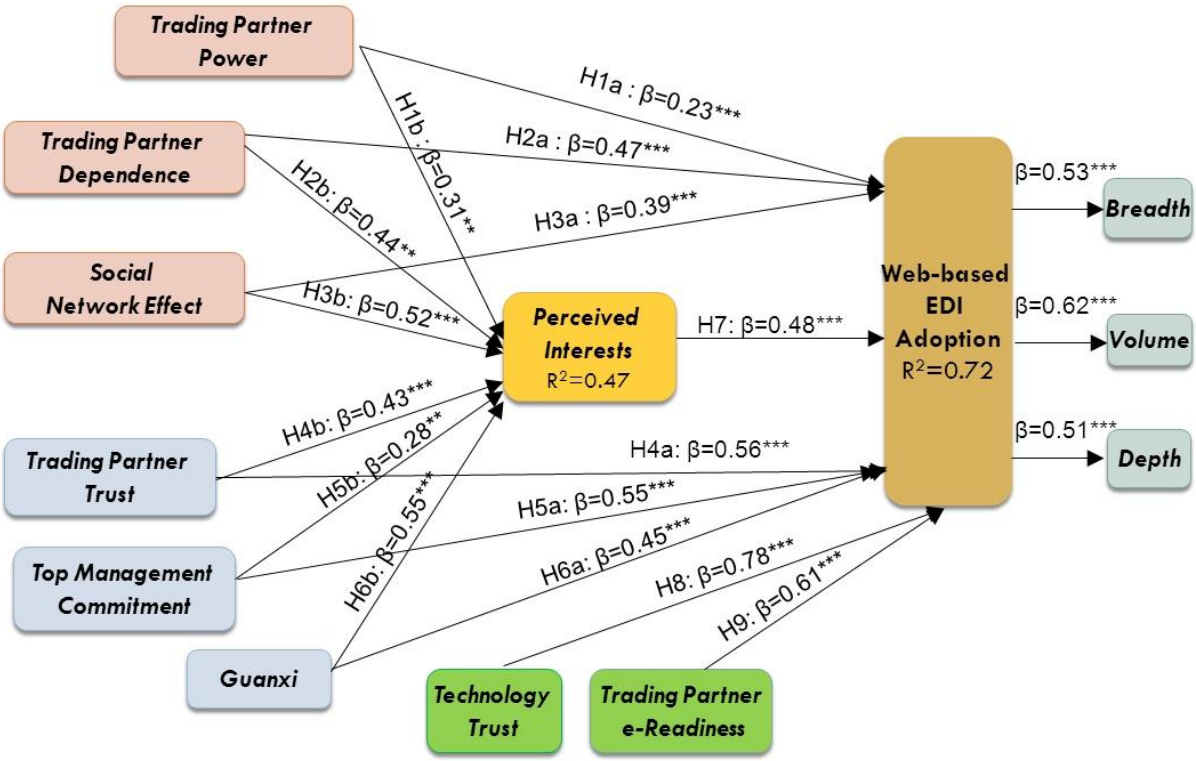
Similar to the previous Case Study 2, partial least squares (PLS) software (SmartPLS version 2.0) was used to test the hypothesised research model linking *Perceived Interests*, Social Resources (*trading partner power*, *trading partner dependence*, and *social network effect*), Relational Resources (*trading partner trust*, *top management commitment* and *guanxi*), Technology State (*technology trust* and *trading partner e-readiness*) and web-based EDI adoption (through three inter-related dimensions: *breadth*, *volume*, and *depth*).

The structural equation model was assessed by estimating the path loadings and the R^2

values. Path loadings indicate the strengths of the relationships between the independent variables and dependent variable. Interpreted like multiple regression results, R^2 values indicate the amount of variance explained by the exogenous variables and measure the predictive power of the structural models. The results of our hypotheses testing are presented in Figure 5.8.

Figure 5.8 shows the results of the PLS analysis performed to test the structural model. In particular, the standardised path coefficients (β), the significance level (t statistic) and the value of the R^2 of the major dependent variables are shown. All the hypotheses are supported, were found to be significant at 0.01 level. The construct of perceived interests explains 47% of variation by both Social and Relational Resources derived from social exchange theory. The construct of web-based EDI adoption explains 72% of the variables for the rest of nine constructs. Overall, the results indicate strong and very significant support for the model. The assessment of the measurement and structural models indicates that the results of the PLS model are acceptable.

Figure 5.8: Case Study 3: Results of PLS Model on Web-based EDI Adoption



Source: Case Study 3

As indicated by path loadings, all the nine constructs (*trading partner power*, *trading partner dependence*, *social network effect*, *trading partner trust*, *top management commitment*, *guanxi*, *perceived interests*, *technology trust*, and *trading partner e-readiness*) had significant positive influences on web-based EDI adoption (β= *0*.23, 0.47, 0.39, 0.56, 0.55, 0.45, 0.48, 0.78 and 0.61, respectively; *p<0.001*). This result confirmed our theoretical expectation and provided support for H1a, H2a, H3a, H4a, H5a, H6a H7, H8, and H9.

Of the three hypotheses (H1b, H2b, H3b) considering the links between *perceived interests* and the **Social Resources**, all three hypotheses are supported. Of the three hypotheses about the *perceived interests* and the **Relational Resources** (*trading partner trust*, *top management commitment*, *guanxi)* – H4b, H5b, H6b – all three of the hypotheses have been confirmed. Tale 5.20 below summaries the results of the hypothesis testing.

Table 5.20: Case Study 3: Summary of Hypothesis Testing

	Path				
	Independent	Dependent	Beta	Significance Level	Outcomes
H1a	TPP	WEDI	0.23	p<0.01	Supported
H2a	TPD	WEDI	0.47	p<0.01	Supported
H3a	SNE	WEDI	0.39	p<0.01	Supported
H4a	TPT	WEDI	0.56	p<0.01	Supported
H5a	TMC	WEDI	0.55	p<0.01	Supported
H6a	GX	WEDI	0.45	p<0.01	Supported
H7	PI	WEDI	0.48	p<0.01	Supported
H8	TT	WEDI	0.78	p<0.01	Supported
H9	TPeR	WEDI	0.61	p<0.01	Supported
H1b	TPP	PI	0.31	P<0.01	Supported
H2b	TPD	PI	0.44	p<0.01	Supported
H3b	SNE	PI	0.52	p<0.01	Supported
H4b	TPT	PI	0.43	p<0.01	Supported
H5b	TMC	PI	0.28	P<0.01	Supported
H6b	GX	PI	0.55	p<0.01	Supported
-	WEDI	Breadth	0.53	p<0.01	Supported
-	WEDI	Volume	0.62	p<0.01	Supported
-	WEDI	Depth	0.51	p<0.01	Supported

Source: Case Study 3

Chapter 6
Discussion

6.1 Introduction

Organisations today operate in a very unpredictable, globalised, competitive and complex business environment and marketplace, emphasis on the integration of available resources and compete on service quality. As firms seek to improve coordination by using information system technology, an open standard web-based EDI is becoming increasingly important. Web-based EDI and the Internet has revolutionised the way information seamlessly shared among organisations, promoting and enabling a major change in inter-organisational relationships.

Thanks to the advance in information technology (such as web-based EDI), which offers more integration of the standardised information flow between the suppliers and the consumers that we gradually see less and less 'organisational boundary' and experiencing a more cooperative business relationship in the modern supply chain. Sound cooperative relationships via web-based EDI is therefore arguably one of the most important competing strategy in extending its organisational boundaries quicker (as the size of the network grows) and building up cross-organisational business relationships.

This study provides empirical evidence that confirms the trend of using the Internet to revolutionise WEDI technologies. In response to the changing business dynamics, web-based EDI (WEDI) has been adopted by the global container shipping industry to efficiently utilise available resources and to build and remain its competitive edge. By adopting a collaborative platform of WEDI system as an enabler of process performance and subsequently create value by developing electronic capability and competences, the benefits of the real-time information sharing has brought a major contribution for companies operating in a complex fast-changing competitive business environment.

To improve the current understanding of social and relational aspects of web-based EDI adoption factors, this study focus on the organisational adoption stage and examine how

business-level social and relational factors influence the web-based EDI adoption. The present study therefore attempts to expand our body of knowledge in this research stream to identify factors that will influence use web-based EDI to support their inter-organisational processes with their key suppliers.

All data were collected by means of an electronic questionnaire. Although this method may limit our panel and lower our response rate, it offers numerous advantages compared to traditional questionnaires, such as saving time and money and the elimination of errors due to data re-entry. A systematic sample was derived from an up-to-date list of firms obtained from the latest *Review of Maritime Transport*, 2011 (RMT), one of United Nations Conference on Trade And Development's (UNCTAD) flagship publications, published annually regarding on the worldwide evolution of container shipping industry.

The results from the web-based survey indicate that the proposed research model is able to explain and predict organisations' adoption of web-based EDI. Eleven causal paths in the proposed model are found to be statistically significant.

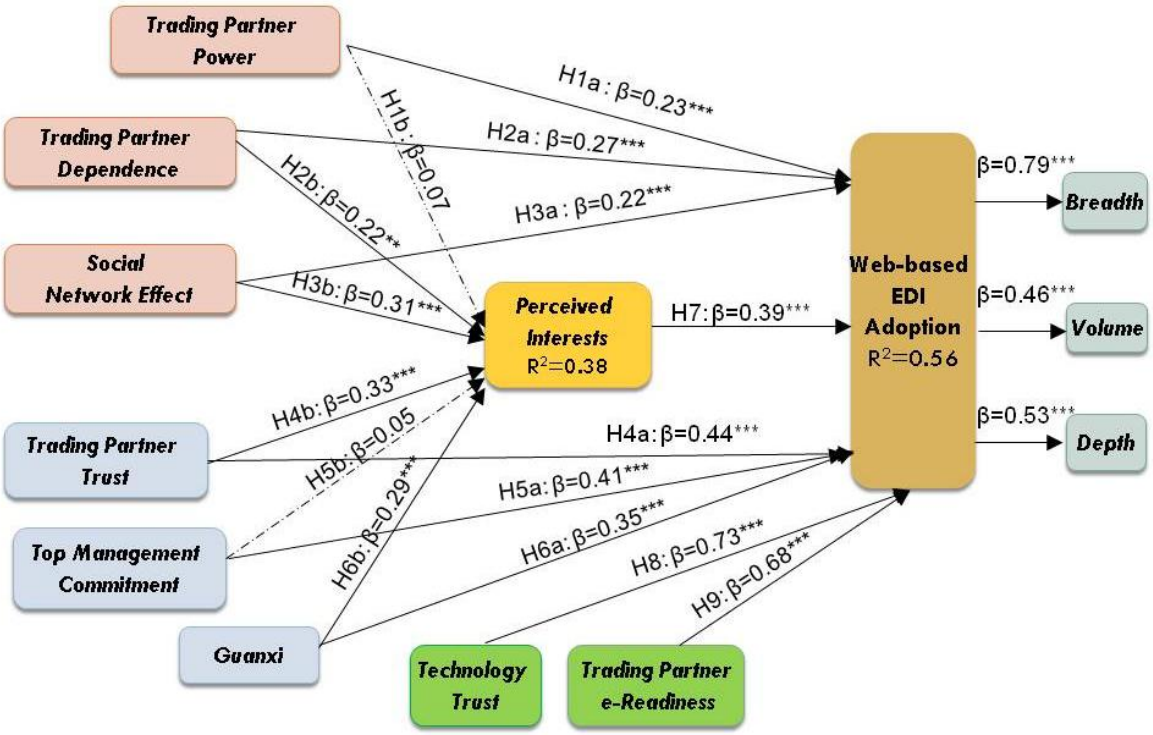
These paths reflect the impact of (1) the social resources, trading partner power, trading partner dependence, social network effect, (2) the relational resources, trust in trading partner, top management commitment, guanxi, (3) perceived interests , and (4) the technology state, including, trust in technology, and trading partner's e-readiness on web-based EDI adoption.

6.2 Discussion of Results

The proposed integrated research model (Figure 3.6) has been tested quantitatively three different case studies through online surveys. After examining its reliability, validity and correlation of the constructs, PLS structural Equation Modelling was applied to test the hypotheses. Figure 5.4 and Figure 5.8 of previous Chapter has shown the results of PLS Model on web-based EDI (WEDI) adoption base on a dataset of 164 respondents from the top 20 leading container shipping liner in year 2009 and 195 respondents of the top 20

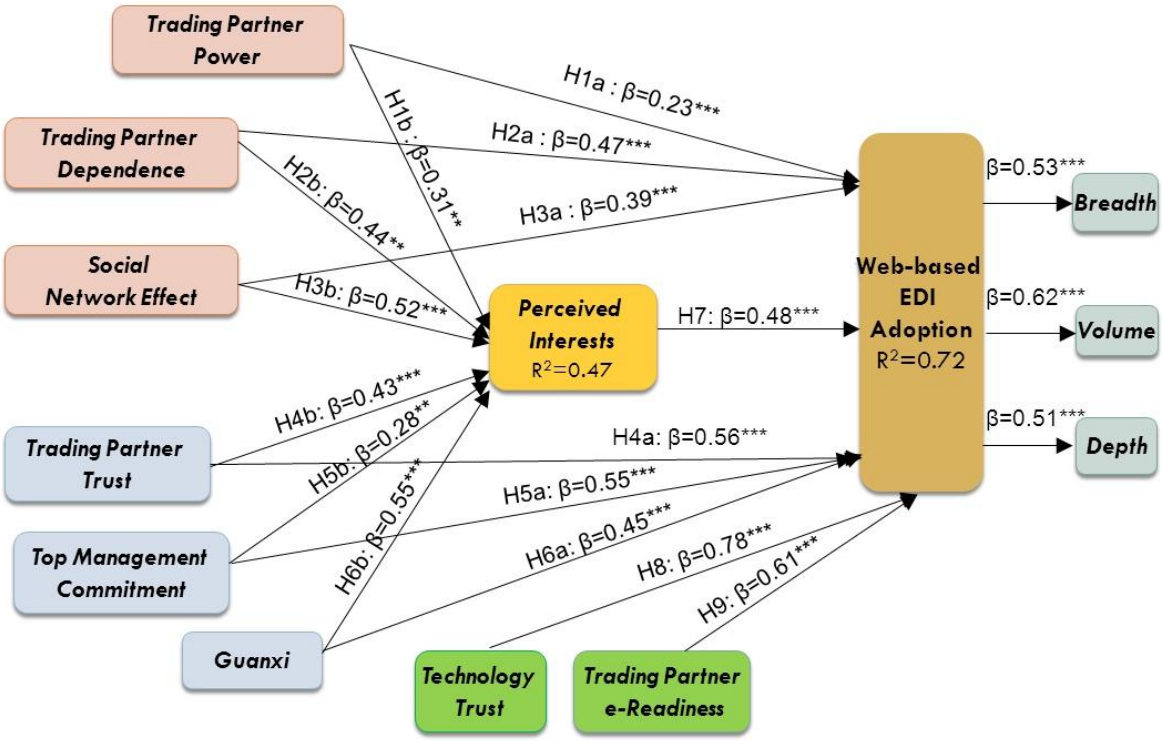
leading container shipping liner in 2012.

Figure 5.4: Case Study 2: Results of PLS Model on Web-based EDI Adoption



Source: Case Study 2

Figure 5.8: Case Study 3: Results of PLS Model on Web-based EDI Adoption



Source: Case Study 3

Out of the 164 unique and valid respondent firms surveyed in 2009, 69% have already been using web-based EDI systems, 31% have not yet adopted. Of the 195 respondent firms surveyed in 2012, 81% have already been using WEDI systems, 19% have not yet adopted. In comparison of these two surveys in this research, there has been a continuous 12% increase in the adoption of WEDI in the container shipping liner industry. This result exhibit consistency with the prediction of WEDI adoption in previous studies that the adoption of WEDI is growing. For those non-WEDI adopters, e-mail/Internet is their most frequent ways of exchanging B2B data between firms. In comparison to the two surveys, it confirms the increasing importance of WEDI in this sector and the data suggest that the use of traditional EDI in the container shipping is diminishing to less than 5% in 2012.

In addition to the increasing usage of WEDI in the sector, the 2012 survey shows an interesting finding regarding to the company size for those WEDI adopting firms. In the 2009 survey, the result showed more small-size company (46.9%) than large-size company (20.4%) adopted WEDI in the container liner shipping sector; in the recent 2012 survey, the result shows more large-size company (35.9%) than small-size company (25.5%) adopted WEDI in the same sector. This result suggests that adoption of WEDI system has become an increasing important role for those larger organisations to who is rather reluctant in adopting WEDI in the past.

Moreover, from the comparison of the main and further studies, the result suggest that companies adopted WEDI system have greater capacity to handle more containers annually, offering broader service routes to their customers and having the capability of handling more business partners than those who not yet adopted. The study also identified that shipping carriers tend to adopt web-based EDI system than any other type of the firm, while the shipping agent or freight forwarders tend to become those non-adopter of the WEDI in container liner shipping.

Since WEDI adoption is a process in which two or more organisations determine how to work together more effective using a standardised electronic data transfer along value-chain activities via Internet, the finding above clearly suggest that web-based EDI

now play a key role in inter-organisational system adoption research especially in the container liner shipping industry. This study investigates organisations' adoption of web-based EDI in container liner shipping industry. To promote the adoption, it is critical to clarify the factors that explain this adoption to improve the understanding social and relational aspects of web-based EDI adoption factors - an enabler of inter-organisational relationship transformation. An analysis of social and relational factors that influence the adoption of web-based EDI will be useful in providing guidelines for evaluating web-based EDI adoption.

Regarding to the test of the hypotheses to the research model, the results support almost all the hypotheses proposed (except for H2b and H6b in the Case Study 2 taken in 2009/10). It can be argued there that it is not simply the adoption of a new technology, but the way how the firm perceived the social and relational factors of their web-based EDI trading partners, for which they will be discussed in the following four categories. They are namely Social Resources, Relational Resources, Perceived Interests and Technology State.

6.2.1 Social Resources

In both studies, Hypothesis 1a is supported as predicted, which means that an organisation tends to adopt web-based EDI when they perceive their trading partner power is greater. Hypothesis 1b is not supported in the Case Study 2; however, it is supported in the Case Study 3. Regarding to the result of Hypothesis 1b, despite there is no direct evidence to explain why there are such differences between Case Study 2 and Case Study 3. However, it is clear to see that the average size of the trading partners (in 2009) in Case Study 3 is more than 30% of the average size of the trading partners the Case Study 2 did in 2012.

Hypothesis 2a is also supported by the data in both studies. This suggests that a firm's dependence on their trading partners is a significant factor to adopt web-based EDI. Hypothesis 2b is also supported by the data, consistent with many other studies of EDI adoption that an organisation's dependence on its trading partner positively associated with its perceived interests of web-based EDI. Therefore, this research confirms trading

partner dependence is positively associated with the perceived interests as well positively associated with the web-based EDI adoption.

Regarding to the impact from the social network effect in this research model, Hypothesis 3a is supported from both studies. This result indicates that social network effect does influence an organisation's adoption decision. In addition to that, Hypothesis 3b is also well supported from both studies, suggesting that social network effects influences an organisation's perceived interests on adoption of web-based EDI. These results confirms the 7 items (SNE1, SNE2, SNE3, SNE4, SNE5, SNE6, SNE8) of the contract and further confirms the empirical study of Zhu *et al*. (2006) in the adoption of open-standard inter-organisational systems.

6.2.2 Relational Resources

Data also proves Hypothesis 4a, 5a, and 6a (i.e., trading partner trust, top management commitment and guanxi) significantly have a positive correlation with an organisation's web-based EDI adoption decision. As predicted, trust has been a very important factor in business-to-business relationships due to the fact that these relationships are often very fragile (Harris and Dibben, 1999). Trust in stakeholders helps improve the relationship between partners and restrains opportunism behaviours in a dyadic relationship. Just like Hart and Saunders (1997) previously mentioned that trust has a positive influence on EDI through encouraging firms to make investments necessary for electronic information exchange and to discourages opportunistic behaviour that would clearly reduce the opportunity for greater information sharing over time. When employees of the organisation trust their EDI trading partners, they are more likely to have positive attitudes toward the work environment as facilitator of new technology. Such positive attitudes toward technology may enhance employee willingness to adopt new technology. The outcome of the hypothesis 4a suggests that trading partner trust is further confirmed to have a positive influence on web-based EDI adoption decisions (Hart and Saunders, 1997; Premkumar and Ramamurthy, 1995).

Furthermore, just as previous research emphasised that top management commitment is

a key factor for EDI adoption, (Premkumar and Ramamurthy, 1995; Crook and Kumar, 1998; Soliman and Janz, 2004), the outcome of hypothesis 4a from both studies suggest that top management commitment has been consistently found as a significant relational factors that can influence organisation's the decision to adopt web-based EDI.

More importantly, regarding to the new contract of guanxi, the result of Hypothesis 6a, supports that guanxi is positively associated with web-based EDI adoption. This finding is significant and very important because this is a brand new construct in the research model has not yet previously being tested before in the literature of inter-organisational system adoption. Hypothesis 4b and 6b are supported by the data in both studies. It demonstrates that trading partner trust and guanxi significantly influences an organisation's perceived interests regarding to the adoption toward web-based EDI. Regarding to Hypothesis 5b, Hypothesis 5b is not supported in the Case Study 2 of 2009; however, it is supported in the Case Study 3 of 2012.

These findings are important, for that they contribute to a better understanding of the dynamics of social relations and their impact on organisation's web-based adoption decisions. If employees hold positive attitudes/ interest toward new technology adoption, they may be less likely to resist technological innovation. Most changes in today's workplace are driven by technological innovation. To make these changes more effective and a part of the organisational culture, managers should instil positive feelings among employees. One way of instilling such positive attitudes is through fair treatment and the development of truthful reciprocal relationships.

6.2.3 Perceived Interests (from Trading Partners)

In addition, from both studies, Hypothesis 7 is also significantly supported in this research model. Since perceived interests go beyond the stand-alone benefits of a technology derived from value chain coordination, market expansion and poetically from cost reduction as network increase, this positive outcome is in line with our expectation and the innovation diffusion theory that shows perceived benefit is an important driver of new technology adoption in web-based EDI.

6.2.4 Technology State

The highly positive result of Hypothesis 8 suggests the trust in technology is highly influenced to an organisation's adoption decision. As people are willing to trust the technology in information systems, the uncertainty that is present in relationships can be either reduced or by how the user perceive their trust in Technology. Through the accumulation of good experiences of knowing and using the new technology, their technology trust can be gradually developed through adopters' perception in adopting new technology. This result is consistent with the findings of Ratnasingam and Pavlou (2003) in which technology trust from an institutional perspective does impact B2B e-commerce adoption and success.

Hypothesis 9 is highly supported from both studies. It indicate that trading partner e-readiness positively influence an organisation's adoption decision. Since the value of the e-business can only be maximised only when many/ more trading partners are using it, the result from both studies show the importance of trading partners' e-readiness to perform value chain activities for web-based EDI adoption.

6.3 Summary

Overall, two hypotheses were not supported in the Case Study 2 of 2009/2010. As one of the three most important attributes associated with the social resource, *trading partner power* had been empirically proven a significant predictor of perceived interests. However, the effect of trading partner power on perceived interests as described in Hypothesis 1b was insignificant in the Case Study 2. This means there is no significant positive correlation between the trading partner power and perceived interests in web-based EDI adoption. This shows that trading partner power cannot influence the evaluation of a business partner about the perceived interests.

This unexpected result may be explained in two ways. One due to the cost involved in setting up and running web-based EDI system requires less costs to the web-based EDI adopters (compared with the traditional EDI). In addition, as the number of the network grows, organisations might have realised the strategic importance of web-based EDI in

their business, so that even smaller firms are willing to invest heavily on technologies that will improve their competitive advantage. As previously (in Table 5.1) shows that more of the smaller firms in 2009/2010 taking part in web-based EDI, trading partner power might have been lowered, so that unable to influence the perceived benefits in web-based EDI adoption context. However, in the Case Study 3 of 2012, when more large-size company adopt web-based EDI than those of the small ones, the support of Hypothesis 1b became the case and indicate that a strong positive relationship between the level of trading partner power and the perceived interests.

Regarding to the results for Hypothesis 5b of Case Study 2, it suggests that the effect of top management commitment on perceived interests was insignificant. The outcome suggests that there is no significant positive correlation between top management commitment and perceived interests in web-based EDI adoption. This shows that top management commitment is not significant enough to influence the evaluation of a trading partner about their perceived interests. Although according to the model, we would expect top management commitment to have positive and significant influence on web-based EDI, rejection of Hypothesis 5b in the Case Study 2 of 2009/10 shows evaluation of a trading partner's perceived interests is not yet significantly influenced by top management commitment. However, it appears that as the adoption of Web-based EDI continuous to grow over the later years, the result of the Case Study 3 of 2012 shows a positive relationship between top management commitment and trading partner's perceived interests.

All data were collected by means of an electronic questionnaire. Although this method may limit our panel and lower our response rate, it offers numerous advantages compared to traditional questionnaires, such as saving time and money and the elimination of errors due to data re-entry. A sample was derived from an up-to-date list of firms obtained from the latest *Review of Maritime Transport*, one of United Nations Conference on Trade And Development's (UNCTAD) flagship publications, published annually regarding on the worldwide evolution of container shipping industry. The results from the web-based survey indicate that the proposed research model is able to explain

and predict organisations' adoption of web-based EDI. Eleven causal paths in the proposed model are found to be statistically significant.

In summary, this study advances our understanding of the effects of web-based EDI-specific social and relational factors on organisation's web-based EDI adoption. As we expected, all the nine factors in four categories are found significantly related to web-based EDI adoption. The result of the web-based EDI adoption model is illustrated in both Figure 5.4. and Figure 5.8 over the 2 studies in 2 different time period. Four groups of factors—social resources, relational resources, perceived interests, and technological state—have contributions toward organisations' adoption of web-based EDI.

Findings also show that all but two characteristics of the collaborative supply chain relationships (in Case Study 2) influence container shipping liners' use of web-based EDI to support transactional processes with their key trading partners. These results indicate that container shipping liner companies will more likely use web-based transactional processes as the size of the network grows larger when those stronger supply chain relationships that can provide them with competitive advantages. Although the two previously expected significant factors, e.g., trading partner power towards perceived interests and top management commitment towards perceived benefits are not significant according to the outcome from the first case study of 2009/2010. After understanding from our research result on the latest WEDI adoption survey, the outcome confirms WEDI been continuously to be adopted in the container-shipping sector and there are more large-size company adopting Web-based EDI than smaller-size company in this sector. Therefore, this proposed research model is a good integrated model in how the business-level social and relational factors influence the adoption of web-based in the context of the container liner shipping industry.

Research results also indicate that, besides the average size of trading partners of those WEDI adaptors is significantly larger than those non-WEDI adaptors in their business relationships. The same set of characteristics of the supply chain relationships influence the dependant variable assessing the use of web-based EDI to support inter-organisational collaborative processes between a container shipping liner

companies and its key suppliers. These interesting findings hint to the fact that external characteristics may similarly influence different types of supply chain collaborative processes. Evidently, these preliminary findings will need to be validated in future empirical studies.

Overall, the results also show that the social resources of *trading partner dependence* and *social network effect* as well as the relational resources of *trading partner trust* and *guanxi*, positively associated with the perceived interests of web-based EDI adoption. Moreover, confirms the nine factors (*trading partner power*, *trading partner dependence*, *social network effect*, *trading partner trust*, *top management commitment*, *guanxi*, *perceived interests*, *technology trust*, and *trading partner e-readiness*) to be positively associated with the web-based EDI adoption decisions. This interesting finding may provide a starting point to attempt to understand why container liner shipping firms will adopt a certain type of web-based EDI when conducting business with particular supply chain partners. Finally, research findings also demonstrate that organisational readiness and firm size are strong determinant of firms' use of web-based IOISs to support inter-organisational relationships with their key suppliers. These results corroborate previous research findings (Iacovou *et al*., 1995) and may partly explain why container-shipping firms still lag behind other firms in term of rate of IT adoption.

Findings also demonstrated that the social and relational characteristics of the supply chain relationships exert a powerful influence on the firms' use of web-based EDI within the container liner-shipping sector. The fact that the dependency and the power with the key trading partners, the trust, guanxi, e-readiness, perceived interest and social network effect with key trading partners, the size of the business network with key suppliers and the technology trust, top management commitment perceived by key suppliers are the nine characteristics of the supply chain relationships that exert a significant influence on the highest number of dependent variables also demonstrates that container liner shipping companies will use information technology to support those supply chain relationships that are built on trust, long-term relationships and mutual cooperation.

These results corroborate previous findings that have argued that supply chain

management practices represents a key opportunity for container liner shipping companies wishing to surpass the web-based EDI adoption barrier and may partly explain why firms in the container liner shipping sector are not yet strong adopters of web-based EDI to support their inter-organisational processes.

Chapter 7
Conclusion

7.1 Overview of the Research and the Container Liner Shipping Industry

Organisations today operate in a complex, unpredictable, globalised, and competitive business environment and challenging marketplace, emphasis on just-in-time deliveries and service quality through the integration of resources. Web-based EDI and the Internet has revolutionised the way information seamlessly shared among organisations, resulting in the radical transformation of organisational practices in many ways, promoting and enabling a major directional change in inter-organisational relationships, which includes relational and social exchange, working partnerships, and trust-based relationships. Sound cooperative relationships via web-based EDI is, therefore, arguably the most important competing strategy in extending its organisational boundaries quicker (as the size of the network grows) and building up cross-organisational business relationships.

7.1.1 The Research Overview

This study provides empirical evidence that confirms the trend of using the Internet to revolutionise web-based EDI (WEDI) technologies. In response to the changing business dynamics, WEDI has been adopted by the global container shipping industry to efficiently utilise available resources and to build and remain its competitive edge. By adopting a collaborative platform of WEDI system as an enabler of process performance and subsequently create value by developing electronic capability and competences, the benefits of the real-time information sharing has brought a major contribution for companies operating in a complex fast-changing competitive business environment.

To improve the current understanding of social and relational aspects of web-based EDI adoption factors, this study focus on the organisational adoption stage and examine how business-level social and relational factors influence the web-based EDI adoption. The present study therefore attempts to expand our body of knowledge in this research stream to identify factors that will influence use web-based EDI to support their inter-organisational processes with their key suppliers. By proposing an approach to

web-based EDI measurement, this research contributes to increase the body of knowledge in the field of web-based EDI. This contribution can expose practitioners to the different ways web-based EDI can be used by global container shipping liner companies to support their relationship with suppliers.

Therefore, the aim of this research is to identify and explore inter-organisational collaboration of web-based EDI's adoption factors in the global container liner shipping industry setting to understand, in particular, how the business-level social and relational factors influence the WEDI adoption in the context of container liner shipping industry. Based on the theoretical foundation around EDI adoption and three key inter-organisational system adoption empirical research (Lee and Lim, 2005; Boonstra and de Vries, 2005; Zhu *et al*., 2006), an integrated conceptual model is then established showing the relationships of the key constructs.

In pursuing our first objective (of determining the key factors that is relevant to the adoption of WEDI), a comprehensive literature review in EDI/ inter-organisational system IOS) adoption was conducted to uncover how the relevant/ associated variables in the proposed research model were operationalised in prior studies. This then enable the researcher to answer the first research question regarding to the key antecedents that affect the adoption activities of web-based EDI.

In pursuing our second objective (of systematically examine the theoretical aspect to be used), previous major inter-organisational system adoption related theories have been considered. The results of three key empirical findings of social and relational measurement (Lee and Lim, 2005; Boonstra and de Vries, 2005; Zhu *et al*., 2006) revealed that most of the operationalisation proposed to date were developed for the particular context of the present research. As such, these observations lead us to develop our own operational means. We proposed an approach to web-based EDI measurement comprising nine facets related to the use of web-based EDI to support both inter-organisational transactional and collaborative processes and taking into account the web-based EDI adoption that can be adopted by container liner shipping companies to support their activities with their supplier.

The operationalisation proposed in this research have nonetheless already been empirically tested in a prior study conducted in a similar context of supply chain relationships. Based on this three key inter-organisational system adoption empirical research, an integrated research model was established of which features 'Social Resources' of (trading *partner power, trading partner dependence and social network effect*), 'Relational Resources' of (*trading partner trust, top management commitment* and *guanxi,* 'Reward' of (*perceived interests*), and 'Technological State' of (*technological trust* and *e-readiness*) as prominent antecedents. As a result, this process enables the researcher to derive the second research question - key social and relational factors attributed to the adoption of WEDI systems in the container liner shipping industry.

To reach the final objective regarding to the proposed research model, a set of nine independent variables were proposed to assess how those factors would influence the web-based EDI adoption decision making within the global container liner shipping companies (in supporting their inter-organisational processes with key suppliers). Consequently, have identified two categories of determinants, namely, those tied to the social characteristics of the organisation and those tied to the relational characteristics of its supply chain relationships.

We then collect data to test the proposed dimensions of web-based EDI use and measure the influence of the determinants on each of those dimensions of use. By proposing an approach to web-based EDI measurement, this research contributes to increase the body of knowledge in the field of web-based EDI. All data was collected electronically through online questionnaire via email. PLS Structural Equation Modelling is used to test the hypotheses. Reliability, validity, and correlations of the constructs were established and shown. Consequently, this enable the research to answer the third research question - extent do those social and relational factors affect the WEDI adoption at business level. That is, to focus on the organisational adoption stage and examine how business level social and relational factors influence the web-based EDI adoption in the context of container liner shipping industry. This contribution has offered practitioners and researchers with a better understanding of how to promote the use of WEDI to a move towards a more collaborative supply chain relationship (see later section of 7.2 and 7.3).

7.1.2 Today's Container Liner Shipping Industry and this Research

This research explores inter-organisational collaboration of Web-based EDI adoption in container shipping liner industry, which is facing a difficult period characterised by increased and continuing containerisation; globalisation; deregulation (which intensified competition on many individual trades and increased the incentive for cooperation; rationalisation; and by horizontal or vertical integration.

The container trade, in fact, has been feeling the brunt of the global recession more than other sectors in shipping. Since the global economic downturn began and triggered by the Wall Street crisis in 2008, the trade has gone through a slump said to be the worst since the introduction of container shipping (see Figure 7.1).

Figure 7.1: World Container Trade and Annual Growth (1999-2011)

Source: Clarkson Research Services Limited

Before the financial crisis hit in 2008, the growth rate for global container trade had averaged approximately 3 times the growth rate of World GDP in 2002-2007. Worldwide container shipping volumes grew at an average annual growth rate of 12.6% during 2002-2007, while world GDP grew by 4.4% in the same period. In 2011, demand for container shipping slowed as the world economy decelerated. World GDP in 2011 rose by 3.9% down from the growth of 5.3% in 2010. Global container trade grew by approximately 7.5% in 2011 down from 12.9% growth in 2010.

Excess supply of container liner services (due to huge new shipping capacity from orders placed several years ago during better economic time), recession in the USA and Japan, on-going Euro zone debt crisis, the declining trend of China's GDP (i.e. one major driving force of demand in the shipping industry), prolonged crisis in the middle East from Arab Uprising and tension in East and South China Sea, reflected on the recent negative growth for international-trade activity. Although there have been periods of rebounds, such as in 2010 when container players made impressive profits, such recover proved to be not sustainable. Following the price war among operators of container liners and then a slump in rates, high oil price of recent years, and the continuous cost-rising of other service operations, container shipping companies saw their profits of around $7 billion in 2010 turn to losses of about $5 billion in 2011.

Forecast from several shipping experts and research houses pointed to slower growth in the year ahead of the global container shipping sectors. Should China's economy growth slower than expected (i.e. 7%), the container shipping line companies would take a bigger hit. World Bank has suggested the world economy will grow largely on the back of the performance of developing countries, as matured economy, the Euro zone and Japan reel from the global recession and financial crises, the global GDP is projected to increase 2.5% in 2012, with growth slightly accelerating to 3.0% and 3.3% in 2013 and 2014.

In addition, total vessel capacity may increase significantly in the next few years because shipping companies ordered new vessels aggressively in 2010. For instance, in March 2012, Alphaliner projected that the worldwide container fleet will grow by 8.1% in 2012, 10.6% in 2013, and 3.2% in 2014, indicated that the capacity of the new vessels entering shippers' fleets during 2012-2014 will be approximately 3.9 million TUE or 26% of the outstanding capacity in 2011.

Both factors suggests the container-shipping sector will have to bear the brunt of a misfiring world economy and global trade sump while the economic uncertainty remains with an increasing ship capacity in 2012-2014 will further intensify competition – a serious concern for the industry and a discouraging sign for shipping liners that ship

owners have trimmed down their fleet size and this downsizing of capacity is expected to continue well into 2013. Consequently, regarding to the container freight rates in the recent years, it exhibits a cyclical pattern due to significant changes in industry demand and/or supply. Freight rates decreased in 2011 because the capacity management discipline of carriers weakened and carriers fought for market share. Over 2012, however, shipping operators successfully rationalised their capacities and increased freight rates.

However, if the shipping carriers fail to manage their fleet capacities, overcapacity must push freight rates down. With a modest outlook for world trade, the container trade is not expected to turn glorious anytime soon over the next few years. This view is in line with the international rating agency, Moody's recent forecast (in May 2012), pointed out the outlook for the global shipping sector over the next 12-18 months remains negative.

Therefore, the punctured profits, excess supply of shipping capacity in the industry and little opportunity for growth has made the market and operating environment for the container shipping industry become very challenging. However, the industry needs to be viewed using long/longer-term lens to appreciate the bright spots within it. Those who against the trend by investing in fleet, and improving collaborative business relationship and diversifying their services offerings during these challenging times will stand to be the first to gain when the world economy rebounds and trade volumes pick up.

Today, due to competitive world emphasis on time and quality based on competition and their contribution to the economic and environmental uncertainty, supply chain management has been recognised as an important concept to guarantee 'just-in-time' deliveries. Container shipping industry no longer constitutes an isolated process of moving goods from point to point, but has become an integral part of overall production and marketing process in the context of global logistics management. Since global container liner shipping involves a large collection of international entities (having many interacting/ interrelated agents) whose interaction create non-linear/ less predictable trends, this study argued that closer collaborative relationships among the large collection of international entities through the adoption of web-based EDI would have a positive impact on firm performance, consequently to increase operation efficiency,

competitiveness and profitability. Especially web-based EDI is an available information technology/system that has a strategic capability where technology transforms the nature of product, process and competition.

Motivated by the lure of sharing cost, risks and resources within the restructuring business climate of the global container liner shipping industry, the modern liner shipping supply chain behaviour is shifting from bilateral, dyadic relationships towards global strategic alliances/ strategic network partnerships. By adopting a collaborative platform of web-based EDI system as an enabler of process performance and subsequently create value by developing electronic capability and competences, the benefits of the real-time information sharing (such as, maximising potential opportunities in global markets, reducing duplication costs/errors, improving supply chain coordination, replacing costly logistics flow and inventory-related costs) will bring a major contribution for companies operating in complex, unpredictable, globalised and competitive business environment.

However, collaboration depends on information sharing and combines multiple trading partners, mutual benefits and the creation of value and inter-organisational collaboration requires sharing critical business information with buyers, suppliers, and even rivals. Therefore, this research has identified the key constructs that contribute to inter-organisational collaboration via Web-based EDI adoption in the container shipping liner industry, in particular with a focus on the business-level social and relational factors. After systematically examine from the previous literature of inter-organisational adoption, based on three key inter-organisational system adoption empirical research (including Lee and Lim, 2005; Boonstra and de Vries, 2005; Zhu *et al.,* 2006), an integrated conceptual model (with nine independent constructs) is then established and tested quantitatively by 3 different case studies through online surveys. After examining its reliability, validity and correlation of the constructs, PLS structural Equation Modelling was applied to test hypotheses.

Since collaboration requires some form of motivation generated by the prospect of realising benefits, such as a reduction in transaction costs or an increase in its productivity or efficiency in operation, this implies leveraging benefits to achieve common goals where

two or more firms share the responsibility for information exchange. However, there is on-going debate over the extent to which common goals and values of partners are a condition for successful collaboration. For example, Cousins (2002) argues that partnership-style relationships do not exist where organisations are competitive and do not trust each other; rather they simply manage risk based on business case decisions.

To adopt collaborative strategies and survive in a business environment that is getting more complex, unpredictable, globalised and competitive, firms must consider not only barriers at organisations and industry level, but also the motivation of powerful trading partners. Supply chain transformation through web-based EDI systems shall not just of inter or intra organisational change, but requires an extra-organisational or meta-view of relationships between all partners. Since relationships do not occur in a vacuum of dyadic ties but rather in a network of influences involving the simultaneous influence of multiple trading partners. This fits with the increasing interest in boundary spanning and trading partners that extend beyond the traditional boundaries of the firm and concerns any group or individual we can affect, or is affected by, the achievement of a corporation's purpose. Therefore, a holistic view of the supply chain that consider concepts such as power, trust, commitment, dependence, perceived interests, readiness, and the effect from guanxi and social network, are important and has been identified as key aspects in WEDI adoption.

Hence, this study argues that the container liner shipping companies shall focus on improving their inter-organisational collaboration with their trading partners through web-based EDI system/technology, in particular, from a social and relational aspect as collaboration is not only an essential ingredient in the management of supply chain performance that requires bridging organisational boundaries and forging cooperative relationships that has been seamlessly connected through the technology of web-based EDI system. This implies shared responsibilities, resources, benefits and the creation of value through common information exchange between firms.

As an enabler of a closer collaborative inter-organisational relationship, the emerging web-based EDI (WEDI), using XML and standard PCs offers a simple, low cost solution for

suppliers seeking connection to their business partner via the Internet, offering an electronic inter-organisational collaborative platform to facilitate and manage the exchange/ share of standardised information (in large quantity) across the logistic supply chain simultaneously.

This e-collaborative platform of WEDI enables each of the business partners (such as, trucking companies, freight forwarders, shipping line carriers, port/ terminal operator, custom, inland depot agent, inter-model operator and shipping agent, etc.) to have real-time data available for container collection or just-in-time delivery, making container shipping liner to provide the door-to-door service more cost-effectively, at same time. As a result, the 'certainly' of the information about what, when and where the container will able to manage the shipping/ warehouse/ other inter-model transportation carriers more efficiently, lowering down operational cost further, and bring up the competitiveness of a container shipping liner company through a more collaborative supply chain relationship through web-based EDI adoption.

7.2 Implications for Theory

Our research contributes to inter-organisational system adoption literature by providing empirical support for the web-based EDI adoption model. We have illustrated the applicability and validity of the nine constructs and their indicators to investigate the concept of web-based EDI adoption. This is an important step because previously social and relational factors are frequently ignored. Since adopting information technology in a business tends to change the value chain from one that is linear to one that is a value network (Baroncelli and Adami, 2003). This allows businesses to extend their relationships with customers, suppliers, peer-companies, brokers, employees and shareholders, and have a more personalised relationship with them (Kandampully, 2003). This is where guanxi and social network effect come into the research model. These personalised relationships are a key goal of relationship marketing, and tend to lead to a more sustainable inter-organisational relationship through web-based EDI adoption.

In this study, we have firstly identified the inter-organisational collaboration of Web-based EDI's adoption factors in the container liner shipping industry to explore and understand how the business-level social and relational factors influence the WEDI adoption. The integrated research model has been established and empirically tested. Each of the instrument development is derived from a comprehensive literature review. The measurement scales of the constructed were adapted from previous studies to the context of this study. This study has contributed the development of the measure to a new contract of guanxi in the context of web-based EDI adoption.

Despite the result from the Case Study 2 of 2009/2010 did not have the full support for the significant positive relationship between power vs. perceived interests and top management vs. perceived interests, this model is fully supported in the Case Study 3 of 2012. The comparison of the two studies confirms the increasing adoption of Web-based EDI in the container-shipping sector and indicates more large-size company adopting Web-based EDI. This important shift of the adopters' profile give us great insight in explaining this research model and has given a good understanding for future researcher to understand how the business-level social and relational factors influence the adoption

of web-based in the context of the container liner shipping industry. In general, our hypotheses are confirmed, our research model is valid, and reliable. The perceived benefits of web-based EDI adoption, technology trust, trading partner e-readiness, trading partner power, trading partner dependence, top management commitment, social network effect and guanxi are the drivers that are statistically significantly positive associated with the adoption decisions.

Through the social exchange theory, we also confirm the research model and the relationships between those social and relational resources. This study contributes empirically by proposing how guanxi can be strategically used beyond the traditional dyadic level to contribute to perceived benefits, and web-based EDI adoption. The role of establishing trust in the underlying web-based EDI technology infrastructure and e-readiness of the trading partner has become important drivers for the value realisation in today's B2B e-commerce.

This study attempts to make a theoretical contribution in the area of business-to-business relationship in web-based EDI adoption by integrating social exchange theory to propose a new theoretical construct (called guanxi) which describes the importance of reciprocal obligations based on social connection or long-term business relationship. The theoretical foundations discussed in this paper contribute to organisational, transaction cost economics, resource dependence, and social exchange theories, as we extend previous research on EDI to explain a process framework within the context of web-based EDI adoption.

To the best of our knowledge, this study is one of the first that examines adoption of web-based EDI using a research model that includes the new construct of guanxi. Using empirical data from the two studies in the container liner shipping industry, we found strong support for our research model, the nine dimensions proposed are all important. As the sample was not limited to data from a single country, this helps to strengthen the generalisation of the model and findings. The overall results indicate strong and very significant support for the research model.

7.3 Implication for Practitioners and Researchers

As there are growing body of studies focus on the buyer-seller relationships in business markets from an academic perspective, researchers have developed conceptual frameworks and integrated models of business-to-business interactions. This study addresses an under-researched area of business-to-business relationships within the logistic supply chain of global container liner shipping companies where there are not only relational but also social impact within parties having impact to the adoption decisions in web-based EDI. A wide variety of relationship-relevant characteristics has been investigated and suggests that industry transformation (of WEDI adoption) is socially, politically and technically complex. The findings of this study increase the awareness of practitioners that inter-organisational adoption is a complex phenomenon, which requires a careful assessment of their relationships with their EDI trading partners. This web-based EDI research model can help practitioners evaluate their existing strategies to facilitate future inter-organisational system adoption.

The results have significant implications for researchers and practitioners. First, managers will be better aware of the importance of trading partner trust from different perspectives and the need to develop sustainable competitive advantages in the exchange relationships. By properly utilising technology trust, this study paves the way for managers to understand how the adoption of web-based EDI can affect their exchange relationships. This study provides a guide for early practitioners of web-based EDI technologies by increasing their levels of awareness on the role and impact of the technologies and best business practices that create technology trust and engender relationship trust via collaborative exchange relationships. Therefore, this study informs managers on how the character of trust can be strategically used to realise business value beyond transaction efficiencies and cost reduction through adoption of web-based EDI.

Second, because top management commitment is confirmed as a significant factor for web-based EDI adoption, it should be used to establish closer relationships and long-term commitment with business partners. Therefore, top management should also recognise that there must be more than just a financial investment to initiate WEDI adoption.

Third, in all the case studies, guanxi was found to be another key variable, indicating that the degree of reciprocal obligations based on social connection increases with its importance in web-based EDI adoption. Firms must pay great attention to their long-term business relationship to provide effective web-based EDI adoption, and provide tangible information and technological infrastructure and human resources. Finally, introducing inter-organisational system involves both technical innovations and considerable environmental and organisational change.

Forth, several areas of concern clearly emerge from this research that reach to the core of the industry, most notably inter-organisational relationships and the impact of the e-collaborative platforms of WEDI systems. Factors such as trading partner power, trading partner trust, dependence with their key trading partners, e-readiness of trading partners, and the perception from the expected benefit have been successfully identified as the key aspects in WEDI adoption. If the industry ignores these concerns then others will take the initiative and lead to a decline in the firm's competitiveness or even challenge the firm's survival in being the fittest within the industry in general.

Overall, we can see that WEDI has been and will be further adopted even more widely across the container liner shipping industry and there is considerable work to be done in building a more integrated electronic logistic supply chain. This can only be achieved by the collective effort between container liner firms and its suppliers working together, realising the benefit when more trading partners become part of the adopters, collaborating with organisations, such as, freight forwarders to achieve a set of common Web standards and protocols across service procurement, collection, supply, in transit, or delivery. As the awareness of the perceived benefits getting larger, the social network effect will set in eventually to enlarge the overall benefit/ increase the opportunity cost of not adoption WEDI that became too significant to ignore.

Despite the advantages of adopting WEDI, we cannot ignore the danger of the data to be used or stolen by the competitors. Hence, the security issue will be an area requires attention by those companies increasingly adopt WEDI in exchanging real-time data.

7.4 Limitations of the Study

As part of this study, we developed and tested a simple framework that categorises EDI adopters and non-adopters into a typology and predicts the expected impact of this technology. Two of the main strengths of this model are its parsimony and the derivation of its factors from previous conceptual and empirical research.

As in most empirical studies, our work is limited in some ways. First, limitation may be seen in the choice of the social and relational constructs that may not fully capture the complex nature of the web-based EDI, in which increasing number of smaller organisations are in the process of adoption.

Secondly, social and relational constructs (perceived interests, trust, power, dependence, guanxi, commitment) do not remain static, particularly during different stage of an IT project life cycle as social network effects increased. The cross-sectional nature of this study does not allow knowing how this relationship will change overtime. To solve this limitation, future research should involve longitude studies to minimise such concern.

Third, despite a number of recent studies had suggested that Internet-based surveys offer substantial advantages over more traditional mail or phone based approaches; however, recent studies have identified a number of important limitations to Internet-based survey research. It is much aware that studies accessing potential participants to participate in a survey by e-mail invitations can sometimes regard as an offensive behaviour (Hudson and Bruckman, 2004), or consider this type of posting to be ‘spam’ (Andrews et al., 2003). Using e-mail invitations to participate in a survey may face rejection by either a community moderator or the members of the community. Thus, the limitation of using such method is based upon the need for permission-based participation.

Even though the Internet has grown to be used by the general public, Internet access still does not reflect the public as a whole. Thus, a sample of Internet users is representative only of Internet users (Tse, 1998; Bradley, 1999) and not all populations are for Internet survey research. Studies conducted via the Internet, to a certain extent, might become

'selective' and can only reach people who have access to the Web, who use it, and who is willing to take part.

With regard to the questionnaires, the view expressed may be confined to the individual in the organisation who 'happened' to be the respondent since there are undoubtedly some individuals who are more likely than others to complete an online survey (i.e. a tendency of some individuals to respond to an invitation to participate in an online survey, while others ignore it). There could be possibilities that only respondents interested in the research topic took the trouble to reply so that one can suspect those replying may be more likely to carry out evaluation and be more satisfied with their evaluation processes than the average non-respondent. All of which are about the limitations of sample representativeness when using this data collection method.

Another important issue may be related to the biases associated with the process of developing or selecting a sampling frame of Internet users. Unlike conventional survey methods, universal population frames do not exist for Internet surveys (Kaye and Johnson, 1999). As a result, sampling frames for this Internet survey are highly dependent on both Lencom's Fast E-mail Extraction software (to determine the sampling frame) as well as, voluntary or permission-based participation, therefore, are vulnerable to systematic differences of both participants and non-participants. Hence, limits the ability to make generalisations about study findings. This, in turn, limits their ability to estimate population parameters, which presents the greatest threat to conducting probability research.

Finally, like many survey studies in the literature, the development of solid instruments in this domain is still an on-going process. As a result, further confirmatory studies of studies are necessary to determine the external validity of the results.

7.5 Area for Future Study

Given the nature of these limitations, future research would benefits from a more active approach to collect data to minimise any sampling bias concerns. As with any other simple model, there is a danger that additional significant factors have not been included in this research model. Researchers who believe that additional variables play a critical role in the adoption and impact of web-based EDI could use our constructs in their studies.

For researchers who are indeed interested in pursuing empirical investigations such as surveys we recommend using our model, previously validated measures. Large-scale, longitudinal surveys can be especially appropriate for addressing this issue. Longitudinal investigations would allow researchers to measure the factors before the adoption of web-based EDI, observe the interventions by the web-based EDI initiators, and, finally, more objectively assess the impact of web-based EDI on the organisations. Such studies would reduce threats to the causal direction of the effects and, perhaps more importantly, would provide needed insights about the proposed relationship between those social, relational factors of web-based EDI.

Finally, although we believe that our model and hypotheses can form the basis of larger scale studies to examine the validity and applicability of the model, further research is needed to complete our understanding of this subject, to improve and refine it. Hence, suggesting that the model to be applied in the context of other industry types as well. Such empirical testing will allow identifying necessary modifications to the model to enlarge its generalisability and isolate the differences in the factors that influence the adoption decisions of both small and large organisations. Future studies are required to assess how the adoption of an open standard inter-organisational system could further improve relationships and results in more sophisticated information systems.

Furthermore, without any doubt, the current competitive environment of the container liner shipping industry is more complex and changes at a faster pace than last decade. The global financial and economic crisis of 2008 has made vulnerable the intricate chain of activity, which comprises the global container line shipping industry. As shipping demand

is highly associated with the world's economic conditions and international-trade activity, globalisation, economic development and the regional demand-supply imbalance for commodities have driven seaborne shipments in the past and will continuous to affect the future of global container shipping line industry. However, events such as terrorist attacks, political instability, or social unrest can negatively affect demand for maritime transport.

For instance, in recent years, in conjunction with the rapid growth in shipping, piracy attacks have become an increasing problem and a real threat as the knock-on effect is very significant. This activity is presently affecting the logistics management of carriers that we have seen carriers are changing their routes in order to protect their vessels from attack, especially in the proximity of the Horn of Africa, where most attacks have taken place in the last few years. Although it is difficult to quantify all the associated costs, privacy is an increasing problem costing the shipping industry as whole by increased insurance costs and protection expenses that will reduce net earnings. Therefore, future studies in global container shipping are required to assess how the adoption of the latest open standard inter-organisational system could minimise the knock-on effect from the piracy threat and results in more cooperative inter-organisational relationships.

Secondly, in addition to the problem of piracy, the recent financial and economic international crisis has caused a breakdown in container industry. In response to this external shock, cooperation among container shipping companies has increased. In order to say profitable in present unstable market, carriers have gradually adopted cooperative schemes in a number of container services, thereby creating new options for carriers that can adapt their financial strategies in order to share the level of investment as well as financial risk. Hence, future studies in global container shipping are required to assess how the adoption of the latest open standard inter-organisational system could enhance the recent cooperative schemes in a number of services and improve inter-organisational relationships.

Last but not the least, with a fairly long history of cooperation since the 1990s with the formation of consortia and global strategic alliances, future cooperation among trading agents will be continuously an important aspect in the industry. In particular, international

economic alliances in trade agreements are influential in the definition of trade flows and development. For instance, China's admittance into the WTO has affected the bilateral negotiation between WTO countries and China itself as well as among former members, but other examples of international trade agreements show similar impacts on international trade processes (such as, NAFTA among North American countries, MERCOSUR in South America, ASEAN-AFTA among 5 Asian countries, the Trans-Pacific Strategic Economic Partnership (TPP) in the Asian-Pacific region). Therefore, future studies in global container shipping may wish to assess how the future developments of the economic alliances in trade agreements influence the adoption of the open standard inter-organisational system of the future.

To conclude, although global container liner shipping sector is set to go through some rough waters in the years ahead, this research has tested and verified an intergraded web-based EDI adoption model based on three previous empirical researches. It is further suggested that global liner-shipping companies will need to focus on improving their inter-organisational collaborative relationship with their trading partners, in particular, from a social and relational aspect to seamlessly, cost-effectively, and fully connect and integrate with all their trading partners through web-based EDI system.

Appendix 1: Case Study 1 Results

Construct	Cronbach's Alpha (α)	Variable	R^2	α if Item Deleted
Trading Partner Power	**.601**	TPP1	**.185**	-
		TPP2	**.185**	-
Trading Partner Dependence	**.771**	TD1	.494	.658
		TD2	.423	.709
		TD3	.286	.752
		TD4	.277	.740
Trading Partner Trust	**.944**	TT1	.681	.939
		TT2	.735	.936
		TT3	.501	.945
		TT4	.836	.932
		TT5	.775	.934
		TT6	.767	.935
		TT7	.848	.936
		TT8	.842	.935
Top Management Commitment	**.946**	TMC1	.820	.937
		TMC2	.847	.934
		TMC3	.747	.937
		TMC4	.802	.934
		TMC5	.750	.936
		TMC6	.761	.936
		TMC7	**.357**	**.948**
		TMC8	**.274**	**.947**
Perceived Interests	**.915**	PI1	.619	.893
		PI2	.652	.889
		PI3	.823	.876
		PI4	.732	.882
		PI5	.577	.898
		PI6	.469	.906
Trading Partner e-Readiness	**.929**	TPER1	.814	.908
		TPER2	.828	.903
		TPER3	.789	.902
		TPER4	.753	.913
Technology Trust	**.955**	TT1	.606	.952
		TT2	.849	.944
		TT3	.823	.945
		TT4	.896	.943
		TT5	.870	.943
		TT6	.734	.948
		TT7	.680	.953
		TT8	.762	.947
Social Network Effect	**.891**	SNE1	.681	.869
		SNE2	.758	.862
		SNE3	.576	.865
		SNE4	.636	.867
		SNE5	.726	.863
		SNE6	.652	.865
		SNE7	**.372**	**.899**
		SNE8	.623	.874

Guanxi	**.918**	**GX1**	**.476**	**.923**
		GX2	.850	.897
		GX3	.861	.894
		GX4	.816	.895
		GX5	.765	.902
		GX6	.793	.895
		GX7	**.576**	**.925**
		GX8	.659	.909

Appendix 2: Constructs - Data Collection Instrument and Sources.

Originally Adopted From	Constructs / Items (1 - Strongly Disagree; 7 - Strong Agree)
Hart and Saunders (1998)	**Trading Partner Power (TPP)** **TPP1**: The trading partner has influenced our decision to use web-based EDI for business transactions with them. **TPP2**: The trading partner, rather than our company, was the main force behind our company's use of web-based EDI with the trading partner. **TPP3**: We will not have adopted the web-based EDI without the request from the EDI trading partner.
Zhu *et al*. (2006)	**Social Network Effect (SNE)** **SNE1**: Because we think, more of our customers are likely to adopt web-based EDI in the future. **SNE2**: Because we think, more of our suppliers are likely to adopt web-based EDI in the future. **SNE3**: Because we think, more of peer companies are likely to adopt web-based EDI in the future. **SNE4**: Because of the extent our existing customers' using of web-based EDI. **SNE5**: Because of the extent our existing supplier's using of web-based EDI. **SNE6**: Because of the extent of existing peer companies' using of web-based EDI. **SNE8**: Because of the belief of web-based EDI is believed to be the future norm in exchanging business information.
Ranganathan *et al*. (2004)	**Trading Partner Dependence (TPD)** **TPD1**: Importance of having continued business relationship with trading partners **TPD2**: Significant proportion of total profits related to profits from sale/service to trading partners. **TPD3**: Dependence of trading partners on firm for achieving their business goals **TPD4**: Bargaining power of trading partners.
New Construct	**GuanXi (GX)** **GX2**: Having Guanxi (relationships) with our partners enables us to establish electronic relationships via web-based EDI. **GX3**:The establishment of Guanxi (relationships) with our partners is important for adopting web-based EDI **GX4**: High levels of Guanxi (relationships) with trading partners further strengthened our electronic relationship via web-based EDI. **GX5**: Establish certain levels of Guanxi (relationships) is essential prior the adoption of web-based EDI **GX6**: Because of the connection of Guanxi (relationships) with our partners, this motivates our company to adopt web-based EDI **GX8**: Having Guanxi (relationships) plays an important role in whether to establish web-based EDI with.

Ngai *et al*. (2004)	**Top Management Commitment (TMC)** **TMC1**: Knowledge and good understanding of top management of web-based EDI is very important in doing business. **TMC2**: Commitment of top management to the adoption of web-based EDI. **TMC3**: Involvement of top management in web-based EDI. **TMC4**: Commitment of top management to web-based EDI throughout the supply chain **TMC5**: Persuasion of employees by top management to participate in the development of web-based EDI. **TMC6**: Establishment of a complete performance measurement system in web-based EDI by top management.
Ratnasingam (2005)	**Technology Trust(TT)** **TT1**: Our company trusts the confidentiality mechanisms in web-based EDI. **TT2**: Our company trusts the accuracy and assurance of web-based EDI. **TT3**: Our company trusts the transaction quality of web-based EDI as being valid and true. **TT4**: Our company trusts the reliability of web-based EDI. **TT5**: Our company trusts the access control mechanisms of web-based EDI. **TT6**: Our company trusts the mechanisms against internal fraud of web-based EDI **TT7**: Our company trusts web-based EDI technology. **TT8**: Our company trusts the future safety of web-based EDI technology.
Hart and Saunders (1998)	**Trading Partner Trust(TPT)** **TPT1**: The honesty and accuracy of deadlines set by the trading partner. **TPT2**: The follow-through in delivering on promises made by the trading partner. **TPT3**: The trading partner's honesty in business dealings. **TPT4**: The competency of the trading partner in accurately and efficiently processing paper work. **TPT5**: The reliability of the computer system of the trading partner **TPT6**: The willingness of the trading partner to share information. **TPT7**: The trading partner's adherence to agreements. **TPT8**: The trading partner's consistency in business dealings.
Ranganathan *et al.* (2004)	**Perceived Interests (PI)** **PI1**: Improved customer service is very important in doing business. **PI2**: Better inventory control. **PI3**: Reduced operations costs **PI4**: Reduced cycle time. **PI5**: Better relationship with suppliers.

Lin (2006)	**Trading Partner eReadiness (TPER)** **TPE1**: The majority trading partners requested adaptation of web-based EDI. **TPE2**: The majority trading partners recommended adaptation of web-based EDI. **TPE3**: Trading partners are generally very knowledgeable regarding technical matters. **TPE4**: Trading partners contain considerable technical expertise.

Appendix 3: E-mail Covering Letter

Royal Holloway
University of London

Academic Survey:

Adoption of web-based EDI in Global Container Shipping Industry

Dear Sir/Madam,

We need your help. At the University of London, we are researching the factors influencing the adoption of web-based EDI in shipping. We need a few minutes of your time to help us complete our survey.

You have been selected randomly from an internet search of the global shipping industry. This study should take no more than 10 minutes of your time. Please be assured that your responses will be remain completely confidential and used in aggregate form only.

- **If you would like to participate in this survey, please click here.**
- **If you do not wish to participate in this survey, please click here.**

  Your name will be deleted from our database and we will not contact you again in relation to our research.

We thank you in advance for your valuable time and assistance.

Yours sincerely,

Mark Yang

Doctorial Researcher

School of Management,

Royal Holloway - University of London,

United Kingdom TW20 0EX

Appendix 4: Online Questionnaire

Front Greeting Page

2009 Web-based EDI Adoption in Global Shipping Industry

Welcome to our 2009 web-based EDI adoption survey!

Royal Holloway, University of London has committed to this research to explore and understand different factors that affect adoption of web-based EDI in the Global Shipping Industry.

The questionnaire will take approximately 10 minutes to complete. Any section of this survey that asks about your organisation is to be used in the academic research and will remain completely confidential. Our findings will be based on anonymous aggregated form.

By way of thanks, we would like to send you an Executive Summary of our findings.

Please click "Start Survey" in the lower left corner of the screen to continue.

Thank you for participating in our survey. Your feedback is important to our research in the web-based EDI adoption.

Questions marked with an asterisk (*) are mandatory.

1 *

Web-based EDI, ***WebEDI***, ***Internet EDI***, or ***EDI over Internet*** is **the automated exchange of standardised data between organisations over the Internet** (using open-standard IOS, such as, AS2, or XML).
(See below for further information)

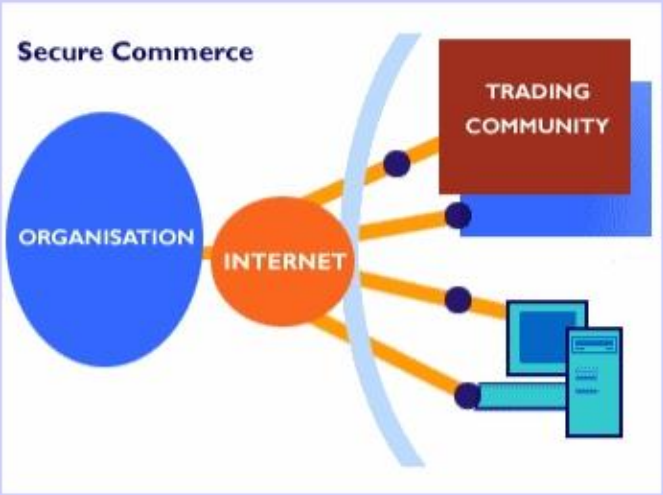
Does your organisation use web-based EDI?

YES NO

- **What is EDI and web-based EDI?**

EDI (Electronic Data Interchange) refers to the automatic exchange of structured electronic transmission of data between organisations usually via a dedicated VAN connection or a private network, and **web-based EDI,** in its simplest form, refers to the EDI **over the Internet**.

Specifically, web-based EDI enables businesses (among trading partners) to **receive** EDI documents and **send** EDI invoices or shipping documents (for example, bills of lading, shipping manifest, advance shipment notification or container status information) by using **web browser** via **Internet connection.** This allows a company to interact with its trading partners, **without** implementing a complex EDI infrastructure.



SUBMIT

Questions marked with an asterisk (*) are mandatory.

- **What is EDI trading partners?**

EDI Trading partners refers to the **organisations** that **send or receive electronic documents between each other via EDI or web-based EDI.**

2 * Has your firm used **web-based EDI** for the following **processes**? (Please click any that apply)

- Reciving Shipping Order (S/O) - (Place booking)
- Integrating business processes with EDI trading partners
- Exchanging operational data with EDI trading partners
- Exchanging operational data with other business customers
- Receiving shipping instructions from shipper (Making the Bill of Lading)
- Customer service and support (such as vessel arrival/departure & container loading/discharging)
- Providing container service information (such as equipment activities & inventory)
- Other, please specify

3 * Please indicate what **percentage** of your company's **total monthly** business transaction do you **estimate** are conducted using web-based EDI? (use **Number only** - between 0 and 100)

4 * Please indicate a percentage range of **total shipping order** booked via web-based EDI in your firm.

5 * Please indicate a percentage range of **total Billing of Lading (B/L)** conducted via web-based EDI in you firm.

6 * Please indicate a percentage range of **total (import & export) manifest** conducted via web-based EDI in your firm.

7 * Please can you rate the **level of integration** (in a scale of 1 to 7) of your firm with each of the statements below.

1 None	2	3	4 Some Integration	5	6	7 Fully Integrated

The degree my firm has integrated web-based EDI with back office enterprise systems and databases.

1 2 3 4 5 6 7

The degree my firm has integrated web-based EDI with EDI trading partners' databases.

1 2 3 4 5 6 7

SUBMIT

Questions marked with an asterisk (*) are mandatory.

- By **clicking** the appropriate point on the scale provided below (in a scale of 1 to 7), please indicate the **extent of your agreement** for the rest of the questions.
- There are **no** right or wrong answers. We are purely interested in a number that truly reflects **your** views.

8 * Please rate your **level of agreement** with each statement.

1 Strongly disagree	2	3	4 Neither agree nor disagree	5	6	7 Strongly agree
The EDI trading partner has influenced our decision to use web-based EDI for business transactions with them.	1	2	3	4	5	6	7
The EDI trading partner, rather than our company, was the main force behind our company's use of web-based EDI with the EDI trading partner.	1	2	3	4	5	6	7
We will not have adopted the web-based EDI without the request from the EDI trading partner.	1	2	3	4	5	6	7

SUBMIT

Questions marked with an asterisk (*) are mandatory.

9

* Please rate your **level of agreement** with each statement concerning **what might have influenced your firms's adoption of web-based EDI**.

1 Strongly disagree	2	3	4 Neither agree nor disagree	5	6	7 Strongly agree
Because we think more of our customers are likely to adopt web-based EDI in the future.	1	2	3	4	5	6	7
Because we think more of our suppliers are likely to adopt web-based EDI in the future.	1	2	3	4	5	6	7
Because we think more of peer companies are likely to adopt web-based EDI in the future.	1	2	3	4	5	6	7
Because of the extent our existing customer's using web-based EDI.	1	2	3	4	5	6	7
Because of the extent our existing supplier's using web-based EDI.	1	2	3	4	5	6	7
Because of the extent of existing peer companies using web-based EDI.	1	2	3	4	5	6	7
Because of the belief of web-based EDI is believed to be the future norm in exchanging business information.	1	2	3	4	5	6	7

SUBMIT

Questions marked with an asterisk (*) are mandatory.

10

* Please rate your view on **the level of importance to your organisation** with each statement.

1 Not important at all	2	3	4 Neutral	5	6	7 Very important

Importance of having continued business relationship with EDI trading partners.

1 2 3 4 5 6 7

Significant proportion of total profits that is related to the profits from the EDI trading partners.

1 2 3 4 5 6 7

Dependence of EDI trading partners on firm for achieving their business goals.

1 2 3 4 5 6 7

Bargaining power of the EDI trading partners.

1 2 3 4 5 6 7

SUBMIT

Questions marked with an asterisk (*) are mandatory.

What is Guanxi?

- **The Chinese term, Guanxi (關係), here refers to your perceoption to the level of relationships between your company and your business partners.**

11 * Please rate your **level of agreement** with each statement.

	1 Strongly dis agree	2	3	4 Neither agree nor dis agree	5	6	7 Strongly agree
Having Guanxi (relationships) with our partners enables us to establish electronic relationships via web-based EDI.	1	2	3	4	5	6	7
The establishment of Guanxi (relationships) with our partners is important for adopting web-based EDI.	1	2	3	4	5	6	7
High levels of Guanxi (relationships) with trading partners further strengthened our electronic relationship via web-based EDI.	1	2	3	4	5	6	7
Establishing certain levels of Guanxi (relationships) is essential prior the adoption of web-based EDI.	1	2	3	4	5	6	7
Because of the connection of Guanxi (relationships) with our partners, this motivates our company to adopt web-based EDI.	1	2	3	4	5	6	7
Having Guanxi (relationships) plays an important role in whether to establish web-based EDI with.	1	2	3	4	5	6	7

SUBMIT

Questions marked with an asterisk (*) are mandatory.

12

* Please indicate your **level of agreement** with each statement regarding to the **adoption of web-based EDI in your organisation**.

1 Strongly dis agree	2	3	4 Neither agree nor dis agree	5	6	7 Strongly agree

Knowledge and good understanding of top management of web-based EDI is very important in doing business.

1 2 3 4 5 6 7

Commitment of top management to the adoption of web-based EDI.

1 2 3 4 5 6 7

Involvement of top management in web-based EDI.

1 2 3 4 5 6 7

Commitment of top management to web-based EDI throughout the supply chain.

1 2 3 4 5 6 7

Persuasion of employees by top management to participate in the development of web-based EDI.

1 2 3 4 5 6 7

Establishment of a complete performance measurement system in web-based EDI by top management.

1 2 3 4 5 6 7

SUBMIT

Questions marked with an asterisk (*) are mandatory.

13 * Please rate your **level of agreement** with each statement.

	1 Strongly dis agree	2	3	4 Neither agree nor dis agree	5	6	7 Strongly agree
Our company trusts the confidentiality mechanisms in web-based EDI.	1	2	3	4	5	6	7
Our company trusts the accuracy and assurance of web-based EDI.	1	2	3	4	5	6	7
Our company trusts the transaction quality of web-based EDI as being valid and true.	1	2	3	4	5	6	7
Our company trusts the reliability of web-based EDI.	1	2	3	4	5	6	7
Our company trusts the access control mechanisms of web-based EDI.	1	2	3	4	5	6	7
Our company trusts the mechanisms against internal fraud of web-based EDI.	1	2	3	4	5	6	7
Our company trusts web-based EDI technology.	1	2	3	4	5	6	7
Our company trusts the future safety of web-based EDI technology.	1	2	3	4	5	6	7

SUBMIT

Questions marked with an asterisk (*) are mandatory.

14

* Please rate your **general level of trust** with your **EDI trading partners** in each statement.

1 Strongly distrust	2	3	4 Neither trust nor distrust	5	6	7 Strongly trust

The honesty and accuracy of deadlines set by the EDI trading partner.

1 2 3 4 5 6 7

The follow-through in delivering on promises made by the EDI trading partner.

1 2 3 4 5 6 7

The EDI trading partner's honesty in business dealings.

1 2 3 4 5 6 7

The competency of the EDI trading partner in accurately and efficiently processing paper work.

1 2 3 4 5 6 7

The reliability of the computer system of the trading partner.

1 2 3 4 5 6 7

The willingness of the EDI trading partner to share information.

1 2 3 4 5 6 7

The EDI trading partner's adherence to agreements.

1 2 3 4 5 6 7

The EDI trading partner's consistency in business dealings.

1 2 3 4 5 6 7

SUBMIT

Questions marked with an asterisk (*) are mandatory.

15

* Please indicate your view to the **level of significance** your company places on certain aspects of web-based EDI.

1 Not Significant at all	2	3	4 Neutral	5	6	7 Very Significant
Improved customer service is very important in doing business.	1	2	3	4	5	6	7
Better inventory control.	1	2	3	4	5	6	7
Reduced operations costs.	1	2	3	4	5	6	7
Reduced cycle time.	1	2	3	4	5	6	7
Better relationship with trading partners.	1	2	3	4	5	6	7

SUBMIT

Questions marked with an asterisk (*) are mandatory.

17 *** Your Profile**

Please select the category which **best describes** your **job title**.

- Vice President or above
- Director or Vice Director
- Manager or Assistant Manager
- Information System Staff
- Operational Staff
- Marketing/ Sales Representative
- Other, please specify

18 **Age**

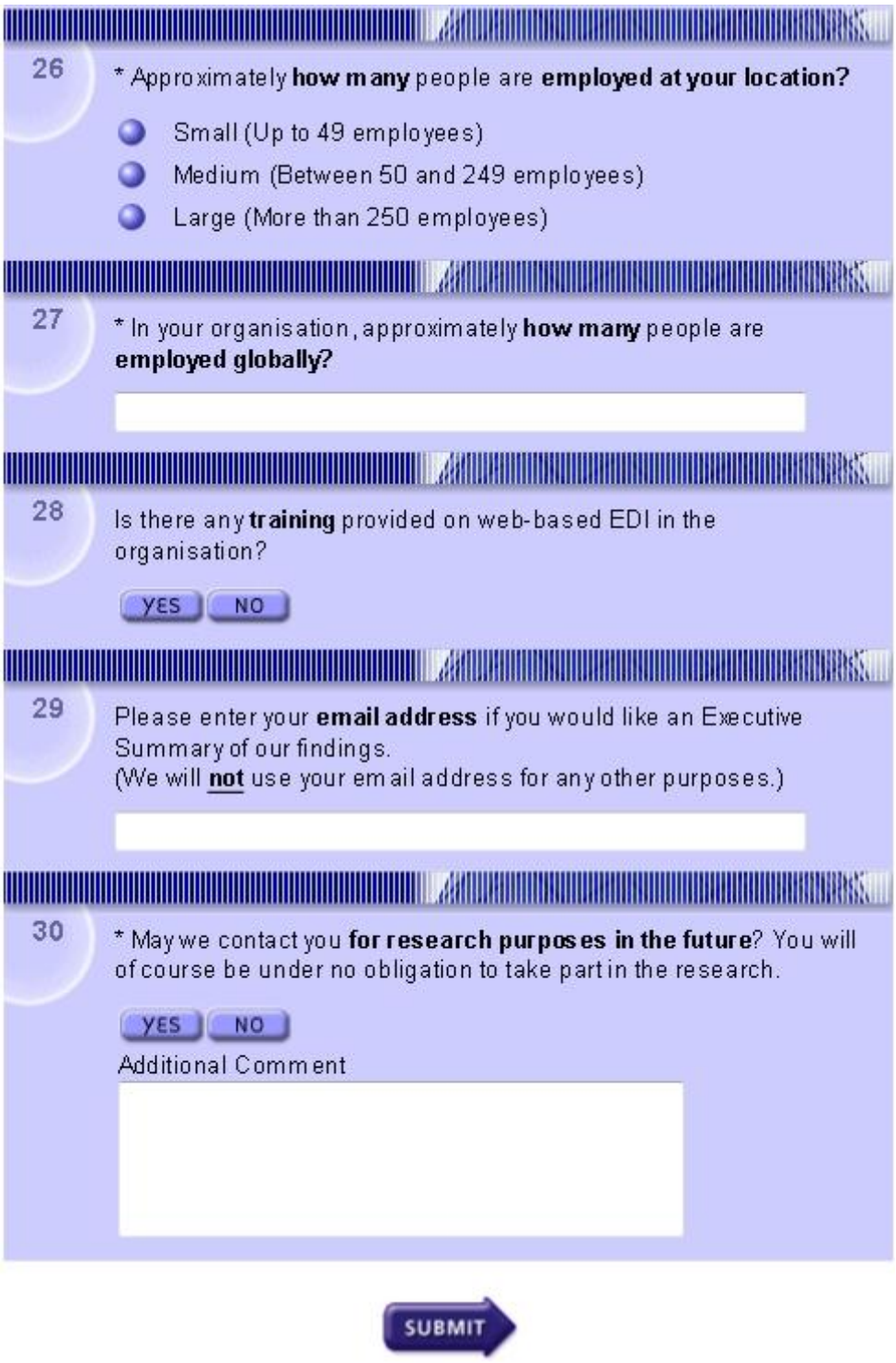
19 * Number of years' **working experience in this firm**

- 1 or below
- 1~5
- 6~10
- 11~15
- 16~20
- 20 or above

20 * Please select your organisation's **primary business activity**?

- Container Shipping Carrier, Shipping Owner
- Freight Forwarder, NOVCC, Custom Agent
- Custom Broker
- Port Authority, Terminal Operator, Inland Depot Agent
- Custom
- Inter-modal Operator, Trucking Companies or Railway
- Shipping Agent
- Shipper, Importer, Exporter
- Other, please specify


21
* Please select the following **service routes** your organisation involved (or related to)?
Far East/America
Inter-Asia
Far East/Europe
America/Europe
Other, please specify
22
* Approximatly **how many TEU per annum** does **your firm handle?**
23
* Approximate **Number** of business partners this year (**2008/09**)
24
* Please tell us, in which **country** are you based?
25
* **Geographic location** of your firm
Europe / Africa
Asia - East (China & CPA, Pacific Asia & Pacific OECD)
Asia - West (Central Asia, Middle East & South Asia)
Latin America
North America



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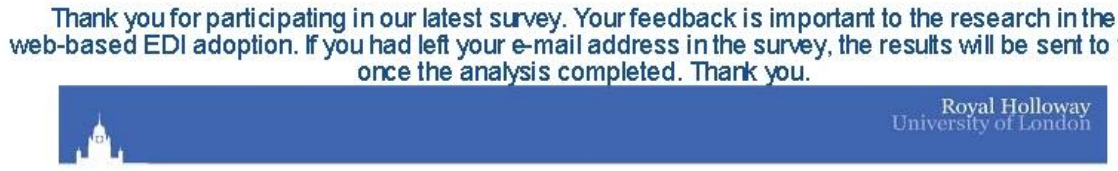

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