Critical Factors for Diffusion of Web Technologies for Supply Chain Management Functions: Malaysian Perspective

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Abstract

Good supply chain management is essential for a successful company. Supply chain management can reach beyond the boundaries of a single company to share that information between suppliers, manufacturers, distributors, and retailers. This is where the information technologies play an important role. Information technology (IT) facilitates companies to share of large amounts of information along the supply chain, and is often referred to as vital facilitator of supply chain management (SCM) functions. As a new medium of communication, the Internet has conquered the world with break taking speed, and it's the worldwide penetration and high level of standardization contributes to increase globalization. With new web technologies, Internet based systems can deliver functionality and information to user a standard web browser, thereby eliminating requirement for traditional Electronic Data Interchange (EDI) or client based software and reducing information technology implementation and maintenance costs, cycles and burdens. The Internet offers the supply chain immense potential and entirely new ways for streamlining coordination between business partners and customers. Therefore, this study explores the use of use technologies for organizational SCM. Based on an extensive survey of Malaysian organizations, it investigates the diffusion of web technologies into supply chain functions. The findings suggested that top management support and Trialability play crucial role for diffusing web technologies in supply chain. This study provides a greater understanding of managers' perception of web technologies diffusion in their organizations. Those interested in adopting web technologies in their supply chain activates may find these results helpful in guiding their effort.

Keywords: Diffusion, Web Technologies, Internet, Supply Chain Management

Background of the Study

The popularity of supply chain management is characterized to several deriving forces, i.e. global sourcing, and an emphasis on time and quality based competition and their respective contributions to greater environmental uncertainty (Mentzer et.al.., 2001). In this dynamic business environment, the competitions are based on time and quality. Providing defect free product to the customer on time is

the fundamental requirement to be a successful organization. In order to meet such requirements, a closer coordination with suppliers and distributor is essential.

The importance of adoption and use of supply chain management enabling technologies has been a common theme in the literature in this field. The idea of using technology to connect trading partners through closer links between information flows and those of physical goods is not new, with some technologies such as EDI, ERP being over 30 years old (Damien and Alan, 2004; Johnston and Mak, 2000). Dramatic economic and strategic changes brought about by recent development in technology, including the internet and the World Wide Web (WWW) has provided more opportunities for business organizations (Soloner and Spence, 2002; Zillur, 2004). Nowhere, have these changes been more evident than in supply chain functions. In the last decade, supply chain has shifted from a low profile, ancillary concern to a recognized strategic component with tangible, positive impact on the firm's bottom line. There was time when the companies could focus on the upstream part of the value chain, especially focusing on their own core competences, lowering their cost, becoming more responsive to customers and so on. But with the advent of Internet and World Wide Web, the goal would be redesigned by a single super objective: competing on the basis of how well managed your supply chain is (Lancioni, 2000). The emergence, direction, and success of e-commerce are arguably the hottest topic in the business media today. At the same time, supply chain management has become a priority item on the agenda of executives as they search for sources of competitive advantage. All theses changes force executives to rethink and redesign their business activities. It is universally accepted the truth that Web technology is incredible enabler, which has capability of radical improvement to the performance of many supply chain activities (Benjamin, and Elsie, 2003; Changsu, and Robert, 2004; Dawn, and Anne, 2004; David, Xin, and David 2004; Debabroto, Rajdeep, and Sambamurthy, 2002; Sanders, 2007; Gray, and Glenn, 2000) It is also true that web technology provides the perfect platform for the tighter coordination which is the benchmark of superlative supply chains.

The Information Technology market in Malaysia is expected to increase from US $1.2 billion in 2007 to US $2 billion in 2012 with a compound annual growth rate of 11.1 percent (IDC[10]). IDC also forecasts that spending for business service will grow between 17 percent to 18 percent in 2009. In addition, Malaysia IT spending is expected to grow between 4% to 5% in 2009, surpassing the US$6 billion mark. This probable scenario is based on the current GDP growth forecast of 3.5% for 2009 by the Malaysia Institute of Economic Research, which led IDC to adjust the 2009 IT spending downwards from its previous 7.6%[11].

In spite of increasing Malaysian IT investment, Malaysian businesses have been relatively slow in web adoption (Alam and Ahsas 2007). According to Lee (2005) here are about 30 percent of Malaysian enterprises have web presence and use information technology in their daily operations. This reflects a poor rate of information technology among the estimated 600,000 local enterprises. Similarly, Tan (2006) argues that Information and Communication Technology (ICT) in Malaysia is facing big challenges due to the slow adoption of technology by Malaysian enterprise. He also mentioned that enterprise must learn to adopt technology to increase their global competitiveness. Yeung et.al. 2003; Chong et. al. 2001; Pires and aAisbett, 2001, they mentioned in their studies that most Malaysian enterprises perceived the barriers of implementing Information Technology into their business operation as expensive initiatives, risk, complex, technical expatriate. Moreover, Mohamed et. al. (2008) mentioned that e-commerce in Malaysia still at infancy stage although country has sufficient infrastructure and technological facilities. However, despite various IT and E-commerce initiatives by Malaysian government, e-commerce penetration among Malaysian firm still very low (Hussin and Noor 2005). Therefore, this study attempts to seek empirical evidence on this issue.

[10] IDC http://www.idc.com.my/PressFiles/IDC%20Malaysia%20-%20Malaysian%20Services%20Market%202009.asp visited 03/30/2009

[11] IDC http://www.idc.com.my/PressFiles/IDC%20Malaysia%20-%202009%20Top%2010%20Predictions%20of%20the%20M%27sia%20ICT.asp visited 03/30/2009

The overarching subject matter is to gain knowledge of the effective diffusion of web technologies in the organizational supply chain functions (Ranganathan, Dhaliwal, Teo, 2004). The general objective of this study is to explicate an empirical understanding of the factors affecting the diffusion of web technologies in supply chain Management. This study tries to fill a knowledge gap about web technology diffusion in supply chain management in Malaysia, and aims to identify the factors that are important diffusion of web technologies in supply chain management. Prior researches in Malaysia are mostly faced on Small and Medium Enterprise, and Electronic Commerce adoption. Very few studies are available on this diffusion of web technology especially on supply chain management. Therefore, we need to better understand the business context of technology adoption decision within companies, in order to generate accurate conclusion about technological innovation (Adham and Ahmad, 2005).

To be competitive with global competition, Malaysian organizations should continue to innovative and adopt appropriate technologies especially in terms of Information and Communication Technology (ICT) facilities (Alam and Ahsan 2007). Hence they suggested by better understanding of the potential benefits that Information and Communication Technology (ICT) can bring, managers should develop a more favourable attitude and become more receptive to the idea of adopting the web technologies.

Literature Review

The digital revolution on the web/internet is believed to be having a major impact on the performance of firms' supply chain functions (Gallear et.al. 2008). Recently, there has been a growing interest in the diffusion of information technologies in supply chain activities across many industries. Such deployments make emergence in the late 1980s of inter-organizational collaboration in the form of cooperative buyer supplier relationship. The use of digital technologies and the internet as a communication platform has been advocated as a significant route for developments in the operation and strategic supply chain management (Croom, 2005) and consequently for providing important new avenue for wealth creation (Amit and Zott, 2001).

Now web technologies and service oriented architectures use Simple Object Access Protocol (SOAP), Web Service Definition Language (WSDL), and XML, as the basic means for Internet connections. Web services communication can involve either simple data passing or two or more service coordinating some activity (David et.al. 2004). The primary aim of the web technologies is to provide a universal set of communications protocols to enable computer systems and business processes to seek each other out over the Internet, and have meaningful interactions without human intervention.

Theoretical Background and Research Model

Two streams of research from the theoretical background for this study: innovation diffusion theory, widely applied in several areas including Internet adoption and diffusion (Rogers 1995).

Diffusion Theory

Diffusion model has been build last 30 years ago by Rogers. Agriculture innovations are the basis of this model. It also has been starting point research within the fields of software and information technology and information system (Kwon and Zmud, 1987; Prescott and Conger, 1995), and has been successfully used to explain problem concerning the diffusion and introduction of innovation.

Rogers (1983) defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system." Rogers also suggests, which is the theory best applicable to this study; five attributes which also have affected on the rate of adoption of an innovation. These are

- **Relative Advantage**: The extent to which an innovation is comprehended as being better than the idea it supersedes.
- **Compatibility**: The degree to which an innovation is perceived as consistent with the existing values, beliefs, experience and needs.
- **Complexity**: This is the difficulty to use and understand the new innovation that it has perceived.
- **Trial ability**: This is an attributes which an innovation may be tried out with on a limited basis.
- **Observability:** The degree to which the result of an innovation are identical.

Different theories have been formulated to determine organizational diffusion process. Using theses theories, Information Technology adoption has been examined at different levels of the organizations such as functional unit (IS unit, Ravichandran, 2000), and entire organizations (Premkumar et. al. 1994). These theories typically deal with decision to adopt (Grover, 1993), intention to adopt (Plouffe et. al. 2001), intention to use (Agarwal and Prased 2002), adoption (Thong and Yap, 1995), and Diffusion (Teng et. al. 2002). Moreover, these theories propose different classes of independent variables, such as innovation characteristics, environmental characteristics, and organizational characteristics. Among these theories, Rogers' Innovation Diffusion Theory and Davis' Technology Acceptance Theory stands out as the only two theories tested in both individual and organizational domains. Other than Roger's and Davis' theories, it appears that theories are not shared among individual and organizational domain (Anand et.al. 2006).

Empirical Studies on DOI with Supply Chain Management

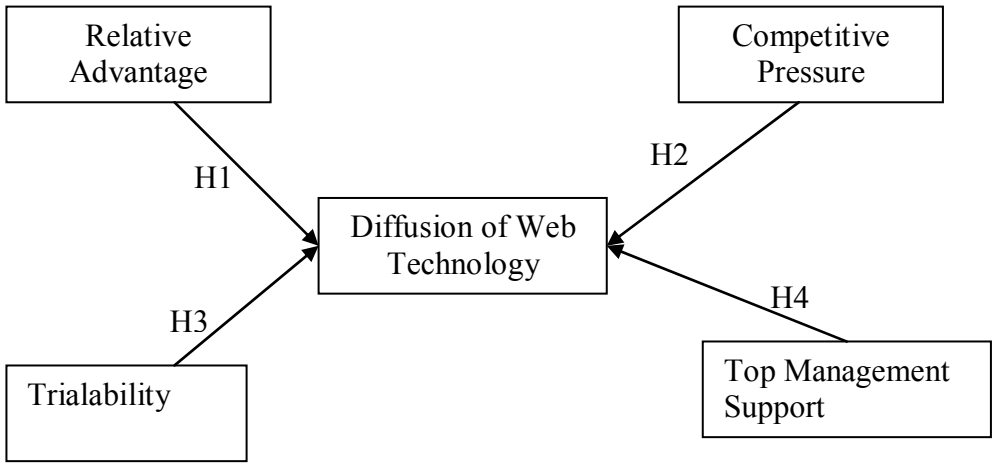
Diffusion theory as prescribed by Rogers (1995) provides a frame work for studying the adoption of new ideas, products, and practices by individuals, consumers, firms or industries. Diffusion literature grew rapidly in the 1960s and 1970s as it described the path of technological innovation. Technology adoption studies presented a series of its usefulness in recent literatures. In one study, Buonanno et. al. (2005) have identified factors that affect enterprise resource planning (ERP) system adoption. The main aims of this research are to provide an insight about enterprise resource planning adoption, highlight contact points and significant differences between the ways small and medium sized enterprises (SME) and large companies approach. This study is based on a wide literature review, focus on the identification of a taxonomy of business and organizational factors influencing ERP adoption. Another study, Harrison and Waite (2005) have study on web site adoption among intermediaries in an extended supply chain. The main purpose of this study is to provide an investigation of e-commerce development via an examination of the force shaping web site development among intermediaries in an extended supply chain. From the qualitative research they find eleven factors that have influence on adoption of website. Peansupap and Walker (2005) have investigated factors that affect adoption of Information and Communication Technology (ICT). The main aim of this study is to address the critical issue of how best to adopt and diffuse information and communication technology (ICT) into organization. In his study, Suraya (2005) has investigated the system of internet adoption among Malaysian travel agencies. She repots after analyzing data that adoption of the internet has enhanced the flexibility and convenience of the travel business activates and enables the introduction of cost cutting strategies. Alam et.al. (2007), in their study, have identified factors that are affecting e-commerce adoption among electronic manufacturing companies in Malaysia with the context of diffusion innovation factors. In another study, To and Ngai (2006) identified different factors, with the context of diffusion theory, affecting organizational adoption of B2C electronic commerce.

Web Technologies Diffusion Studies

Web-based systems are fundamentally different from traditional EDI systems, which were based primarily on the idea of locking in customers and suppliers, and thereby led to higher switching costs. Web technologies and systems, relatively inexpensive and highly flexible, have greatly reduced the switching costs of suppliers and customers (Porter, 2001).Given the increased usage of Web-based SCM systems, it is also necessary to ascertain the true impact of these systems, and to identify the factors that facilitate their assimilation and diffusion (Ranganathan, et.al. 2004). In one study, Chan and Ngai (2007) examined how ten organizations adopted web based training. To identify the answers, they used qualitative field study. They concluded that three main factors significantly affect the adoption of web based training. These are perceived benefits/costs, organizational readiness, and external pressures. In other study, Nikas and Poulymenakou (2008) captured the appropriation dynamics of web based collaboration support in a project team. They identified three major factors for appropriation dynamics of web based collaboration. These are technology, organizational environment, and group structures. In another study, Doolin and Troshani (2007) examined driving forces for XBRL adoption within organizations. Their case studies' results showed very interesting findings. They found that the traditional innovation related factors of relative advantages, complexity, trialability and observability are played a largely negative role in XBRL adoption. They also revealed that XBRL education and training, supporting software, and readiness of XBRL has positive effect too. With all these discussion, we developed our conceptual framework for this study, which described below.

The literatures discussed in previous sections identified different factors that may be influenced web technologies diffusion in supply chain. Interrelationship between theses factors have been empirically tested in different technological context, such as Web services, Web technologies, EDI, ERP and so on. The proposed framework contains five hypothesised relationship that will be tested in supply chain context. A model of that framework is shown figure 1.

Figure 1: Conceptual Model for This Study



Relative Advantage (RA)

Relative advantage is "the degree to which an innovation is perceived as being better than" (Rogers, 1995, p. 212) a competing or preceding idea. A large relative advantage increases the adoption rate. Rogers (1995) lists portable radio, ballpoint pens, as example, of products that were all so clearly superior in convenience to the products they replaced that they became popular very quickly. Relative advantage has been found to be one of the best predictors and positively related to an innovation's rate of adoption (Premkumar, et al., 1994, Rogers, 1995; Tan and Teo, 2000; Doolin and Troshani, 2007; Alam et al. 2007). In the view of the advantages that Web technologies offer, it would thus be expected

that companies who perceived Web technologies as advantageous would also be likely to adopt the Web technologies in their supply chain functions. This lead to the H1

Null Hypothesis (H1) *The Diffusion of Web technologies in Supply Chain Management by the Malaysian Business Organization is not related to the relative advantage*

Alternative Hypothesis(H1) *The Diffusion of Web technologies in Supply Chain Management by the Malaysian Business Organization is positively related to the relative advantage*

Competitive Pressure

It has been suggested that firms experiencing strong competition will have higher rates of adoption of technological innovations (Gatignon and Robertson, 1989; Teo et al., 2003; Warrts et al., 2002). Companies tend to be more responsive and cautious about the actions of competitors in an environment in which they face rival pressure, so they will be more eager to follow their competitors in adopting new technologies. Competitive pressure has long been recognized as an important impetus for adopting innovation (e.g. Iacovou et al. 1995; Premkumar and Ramamurthy, 1995; Zhu and Kraemer, 2005; Zhu et al. 2003). Competition is a significant determinant for innovation adoption. Rival pressure appears to raise its likelihood in a firm. It is because of non-adopters in the areas enabled by the innovations might be perceived to be lower or actually be lower than those adopters (To and Ngai 2006). Therefore, when firms embarks upon Web technologies diffusion, other industry players feel the pressure to eliminate their competitor's advantages as soon as possible (Poston and Grabski, 2001; Ranganathan et al. 2004). Hence it leads the following hypothesis

Null Hypothesis (H2) *The Diffusion of Web technologies in Supply Chain Management by the Malaysian Business Organization is not related to the Competitive Pressure*

Alternative Hypothesis (H2) *The Diffusion of Web technologies in Supply Chain Management by the Malaysian Business Organization is positively related to the Competitive Pressure*

Trialability

Trialability is defined as "the degree to which an innovation may be experimented with on a limited basis". New ideas that can be tried on the instalment plan are generally adopted more rapidly then innovations that are not divisible (Rogers, 1995). Trialability is innovation characteristics drawn from the work of Rogers (2003). It is related to risk (Fichman and Kemerer 1993). Trialling an innovation helps reduce the uncertainty surrounding its adoption and allow potential adopters to evaluate the benefit of adoption. The ability to experience the benefits of Web Technologies is an important factor in diffusion decision (Doolin and Troshani, 2007). May of the web technologies, such as XBML, implementations that had been trialled at the time of the interviews were considered 'pilot' in order to demonstrate 'proof of concept'. Many of other recent studies (Alam et al. 2007; Doolin and Troshani, 2007; Gerrard and Cunningham, 2003; Oh et al. 2003) have considered an important determent for innovation diffusion in different technological context, such as, XBML, E-Commerce, Broadband Internet etc. Therefore, the hypothesis is

Null Hypothesis (H3) *The Diffusion of Web technologies in Supply Chain Management by the Malaysian Business Organization is not related to the Trialability*

Alternative Hypothesis (H3) *The Diffusion of Web technologies in Supply Chain Management by the Malaysian Business Organization is positively related to the Trialability*

Top Management Support

The increasing opportunities to use technology to achieve strategic advantage require the top management be personally knowledgeable of its potential and proactively involved in its diffusion in order to manage it effectively (Jackson et al. 1995). Management support has been identified by numerous researches as a key factor of diffusion or implementation (Agus, 2001; Al-Qirim 2007; Antony et al., 2002; Chen, 1997; Higgins and Hogan 1999; Lee et al. 2006; Mosbeh and Soliman 2008; Nagi et al. 2004; Seyal et al. 2007; Sharma and Gadenne, 2001; Sohail and Teo, 2003; Sureshchandar et al., 2001; Thiagarajan and Zairi, 1998). Management support and involvement in the Web technologies development process in supply chain management can increase the possibility that the logical designs of web technologies reflect properly the organizational goals and objectives, as well as organizational needs. The most consistent findings across prior implementation studies is the importance of management support in successful implementation. These results lead to the following hypothesis

Null Hypothesis (H4)	*The Diffusion of Web technologies in Supply Chain Management by the Malaysian Business Organization is not related to the Top Management Support*
Alternative Hypothesis (H4)	*The Diffusion of Web technologies in Supply Chain Management by the Malaysian Business Organization is positively related to the Top Management Support*

Methodology

A field survey was adopted for the study. An initial sampling frame was assembled from the Malaysian Manufacturer (FMM), Malaysian Industrial Development Authority (MIDA), SAP, Port Klan Shipping Agencies Association 2006 listed members. The list included the company's total employees, annual turnover and year of incorporation of business. 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, ERP, SAP, Rosettanet etc., for their supply chain activities. Out of 2575 organizations, we have selected 1000 organizations. Data collection was completed in December 2008. In general, response rates greater than 20 percent 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.

Table 1 presents the demographic profile of the respondent firms. The sample had a different representation in terms of industry categories. The firms are the samples were fairly distributed across different industry groups in manufacturing and service related industries. The responding firms were from broad range of revenue, including more than 50 million (2.4 percent), 10 to 50 million (9.6 percent), 5-10 million (21.9 percent), 1 to 5 million (47.8 percent) and less than 1 million (18.3 percent). As shown in table 1 all the firms in the final sample had already used Web enabled technologies in SCM. Almost 93 percent of the firms had deployed web enabled technologies more than or equal 2 years.

The large majority respondents were Operation and General Managers. Half of the respondents' organizations have less than 500 employees. 27.5 percent has 500-1000 employees, and 7.6 percent have 1000-2000 employees.

Response bias is always a conce in survey research, especially when the response rate is low (Ranganathan et al. 2004). To solve this 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 nonrespondents (Kanuk and Berenson 1975). Nonrespondents bias was checked by comparing early and late respondents firms on all the key research constructs in the model. The t-test reveled no

significant differences in the means of the research constructs between the two groups. 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.

Measures

Most of the construct in this study are measures from the literature that were adapted to the context of the study. Multiple item measures were used to assess the research constructs. All the items were measured using a 5- point Likert scale. The content validity of the measures was assessed by pretest with knowledgeable experts. The items for measuring diffusion tapped the extent to which web technologies and applications were used in internal and external supply chain activities. Diffusion was assessed by asking respondents about the extent to which they used web technologies and application in internal and external activities such as purchase order processing, demand management (External, Ranganathan et al. 2004) and transaction set types weighted by the portion of business and transaction of each of this type conducted via Web technologies (Internal, Ramamurthy et al. 1999).

Relative advantage was measured using four items adapted from Alam etal. (2008). Relative advantage was assessed by asking respondents about the usefulness of web technologies by finishing task more quickly, increasing job performance, increase individual productivity and is useful for the work.

Table 1: Demographic Profile of Respondents

	Frequency	%		Frequency	%
Industry			**Annual Revenue**		
Engineering	22	8.8	< 1 million	46	18.3
Chemicals	7	2.8	1-5 million	120	47.8
Finance/Banking/Insurance	14	5.6	5-10 million	55	21.9
Computer/IT	29	11.6	10-50 million	24	9.6
Medical/Health Care	8	3.2	more than 50 million	6	2.4
Oil/Gas	10	4.0	**No Employee**		
Business Service	27	10.8	Less than 500	147	58.6
Telecommunication	8	3.2	500-1000	69	27.5
Textile/Apparel	8	3.2	1000-2000	19	7.6
Real Estate/property	14	5.6	2000-3000	8	3.2
Publishing/Information/News	5	2.0	3000-4000	1	.4
Retailing/Wholesales/Trading	13	5.2	4000-5000	2	.8
Transportation/Logistics	24	9.6	more than 5000	5	2.0
Hotel/Travel/Tourism	32	12.7			
Automotive	7	2.8			
Consumer Durables	9	3.6			
Others	14	5.6			
Position			**Year of Using Internet**		
CIO/CTO/Vice President for IS/Senior Vice President for IS	23	9.2	<1 year	8	3.2
Senior Director/Director for IS	76	30.3	1 year	5	2.0
General Manager/Manager/Assistant Director	54	21.5	2 years	24	9.6
E-Business Manager	13	5.2	3 years	28	11.2
Project Manager	13	5.2	4 years	21	8.4
Operation & Production Manager	54	21.5	5 years	6	2.4
Other	18	7.2	more than 5 years	159	63.3

Again four items capturing the Top Management Support construct were derived from Mosbeh and Soliman 2008; and Nagi et al. 2004). These assessed the perception of the responding firm on the extent to which level of top management has interest in web technology, top management shows clear

and visible commitment towards web technology, usages of web technologies is strongly championed and advocated by our organization and finally involvement of top management in web technologies. Trialability using four items obtained from Alam et al. (2007). These focused on extent of trial of the technologies before implementing. Lastly, competitive pressure also measured by four items adapted from Mosbeh and Soliman, 2008; and Bradford and Florin 2003. Theses mainly concern on external pressure from partners or competitors. Lastly, competitive pressure also measured by four items adapted from Mosbeh and Soliman, 2008; and Bradford and Florin 2003. Theses mainly concern on external pressure from partners or competitors.

Validity and Reliability of Measures

Significant precautions were taken during the various stages of development, pretest, and pilot test of the instrument to ensure a high degree of content validity. Construct validity was examined from two perspectives, unidimensionality and discriminant validity and evaluated through factor analysis. The three usually accepted decision rules is research (egenvalue ≥1; factor loading ≥ 0.05; and simplicity of structure) were employed for identification of the factors (Hair et al. 1992). The reliability of the extracted factors was evaluated through Cronbach's alpha test. The results of the tests for unidimensionality or discriminant validity are reported in table 2. The results of the factor analysis were satisfactory; all the indicators items measuring the various constructs loaded on the appropriate constructs. A five factors solution emerged as predefined. The overall variance explained was satisfactory at 79.693 percent. The factor loading were quite satisfactory, ranging from .790 to .857.

These extracted factors were subjected to further refinement to eliminate any outliers to the variable to establish (Churchill 1979). Cronbach's alpha was employed as the criterion to evaluate reliability of the constructs by examining their internal consistency. The details of alpha coefficient are provided in table 3. All the five factors have satisfactory alpha values that are higher than the 0.60 established for exploratory research (Churchill 1979; Nunnally 1978). Based on the findings of these test, we concluded that the research variables in this study meet the various criteria for evaluating and demonstrating satisfactory psychometric properties.

Table 2: tests for unidimensionality or discriminant validity

	Egenvalue	**Factors Loading**	**% of Variance**
Factor 1 (Top Management Support)	7.644		47.775
Top management support 1		.857	
Top management support 5		.845	
Top management support 3		.844	
Top management support 4		.803	
Factor 2 (Trialability)	2.499		15.616
Trialability 2		.826	
Trialability 1		.819	
Trialability 3		.805	
Trialability 4		.766	
Factor 3 (Relative advantage)	1.564		9.77
relative advantage 3		.878	
relative advantage 1		.874	
relative advantage 2		.858	
relative advantage 4		.836	
Factor 4 (Competitive Pressure)	1.044		6.525
Competitive Pressure 1		.798	
Competitive Pressure 4		.798	
Competitive Pressure 5		.793	
Competitive Pressure 3		.790	

Table 3: Reliability Test

Composite factors	Alpha
Top Management Support	.9234
Trialability	.8987
Relative advantage	.9026
Competitive Pressure	.9269
Diffusion of Web Technologies	.9259

Normality of Data and Multi-Collinearity

This study involves a relatively large sample (251 companies) and therefore, the central limit theorem could be applied. Two major methods were utilized in order to determine the presence of multi-collinearity among independent variables in this study. These methodologies involved calculation of both a tolerance test and variance inflation factor (VIF) (Kleinbaum et al., 1988). The results of these analyzes are presented in Table 4. As can be seen from these data:

- none of the tolerance levels is < or equal to 0.01; and
- All VIF values are well below 10.

Therefore, we can conclude that there is no multicollinearity exists in this research, which gives us confident to test hypothesis.

Testing of Hypothesis

Table 5 presents the results of a multiple regression analysis used to evaluate the strength of the proposed relationship. Four hypotheses were formulated and all the variables retain after filtering with factor analysis and theoretical background. In order to test the four hypotheses, linear regression was used, regressing each of the independent variables toward diffusion of web technologies as the dependent variables.

Table 4: Test of collinearity

Variables	Tolerance	VIF
Top Management Support	0.136	6.933
Trialability	0.201	4.263
Relative advantage	0.421	2.013
Competitive Pressure	0.447	2.238

Table 5: Multiple Regression Test

Variable	Estimate	Standard Error	P Value
Top Management Support	.479	.041	.000
Trialability	.457	.041	.000
Relative advantage	.144	.041	.001
Competitive Pressure	.357	.041	.000

Note: R^2 = .587; Adjusted R^2 = .580; F value = 87.370; Sig value = .000

As seen in the table, all the hypotheses are supported. The results illustrated that the diffusion of web technology can be predicted by the Relative advantage (H1), Competitive Pressure (H2), Triabability (H3), and Top Management Support (H4).

The overall results on the diffusion of web technologies confirm Rogers (1995) theory regarding the influence of Trialability and Relative Advantage. The support of H1 (Relative advantage) is in line with the results founded by Alam et al. (2007). Results shows relative advantage having (beta value = .144; P-value = .001) is one of the strong predictor of Web technologies diffusion. It is

expected since past literature has consistently shown that relative advantage has a significant and positive influence on diffusion of new technologies

.Studies like those carried out by Zhu and Kraemer, (2005) Zhu et al. (2003); To and Ngai (2006) have generally shown that competitive pressure has a positive influence on the diffusion of an innovation. Regression analysis showed competitive pressure having beta and p value .357 and .000 respectively. This research therefore further proves the earlier findings that showed if there is pressure from competitors, organization will diffusion more web technologies in their supply chain activities.

The acceptance of H3 (Trialability) is in agreement with the wide range of previous findings (Doolin and Troshani, 2007; Gerrard and Cunningham, 2003; Oh et al. 2003; Tan and Teo, 2000). Multiple regression analysis shows results of Trialability (beta = .457 and p value .000) indicating that Trialability has a positive effect upon Web technologies diffusion among Malaysian organizations. All the previous studies suggest that the more trial option a new technology, the more likely it is that it will be adopted. Our result is also not against this.

Finally, the support for H4 (Top Management Support), the most influential among four, is line with the results of many prior studies (Al-Qirim 2007; Mosbeh and Soliman 2008; Lee et al. 2006; Seyal et al. 2007). Multiple regression analysis shows results of (beta = .479, p value = .000) that there is a positive and significant effect on diffusion of web technologies in supply chain functions. This research therefore further proves the earlier findings that showed top management support as having positive and significant influence on web technology diffusion.

Conclusion

More and more firms are diffusing web technologies and system in their supply chain operations, but there has been little empirical research on the diffusion of web technologies. Drawing upon theoretical perspective from organizational theory, IS research, and SCM research, the study describe in this paper investigated the key factors that affect the diffusion of web technologies in SCM.

Among all the factors, Top Management Support was found to have a greater positive effect on the diffusion of Web technologies in SCM. Although one recent research found insignificant effect of Trialability on EC adoption by organization (Alam et al. 2007), but our results showed that it is the second most significant factor for diffusion of web technologies. It is because most of the firms in Malaysia perceived that adopting new technologies is expensive (Yeung et.al. 2003). Therefore, if there is option for trying before implementing, organization will diffuse more and more.

This research added two new variables with diffusion of innovation and TAM theory. These were Top Management Support and Competitive pressure. Both are important determinants for diffusion of technology as we found significant in our analysis. Therefore, it would be an valuable contribution for the academicians and researchers.

Contributions to Research and Practice

The study summarized in this paper has made some important contribution. It contributes to the emerging body of research on Web technologies diffusion in organization. It identifies factors empirically which influencing diffusion of web technologies in Supply Chain functions. This research provides insights into real Malaysian Web SCM efforts, an area where there have been relatively few empirical studies based on field data because of the dominance of analytical modeling and practitioner case study as the main approaches to the study of SCM (Ranganathan et al. 2004). It is grounded on existing theories of Innovation and Technology acceptance model. By building on earlier research, the study shows how these theories can be used to explain the diffusion of Web based SCM.

Limitation and Further Research

While every effort was made to make this study as comprehensive as possible, certain limitations were present

The study used the adopters of Web systems as the unit of analysis. It captured the measures and the relationships as viewed by the adopter/initiator firms. A good extension of the study would be to have suppliers or buyer–supplier dyads as the unit of analysis.

Another limitation is the use of a single respondent from each target firm, without collecting and cross-validating responses from other informants in the same firm. The use of single respondents is questionable, because relying on only one informant to make complex social judgments about organizational characteristics increases random measurement error. However, the cost of using multiple informants and the possibility of lower response rates were deterrents against the use of multiple respondents. Future research can mitigate the problem of common method bias by collecting data from more than one respondent per firm and comparing the perceptions of different stakeholders in SCM diffusion.

The study examined only a few variables that impact Web diffusion. Several other factors, such as the relative advantages, perceived ease of use, complexity could also influence Web diffusion. This is another area for future research.

Lastly owing to the following main reasons, the sample may not be representative of the population

- Some address taken were found to be wrong
- Non cooperative behaviour of the respondents and
- Time and financial constraints

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