

How Technology Appropriateness Affects Its Usage and Outcomes : The Korea's National Single Window Experience

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Abstract

Global trading is an intrinsically complex endeavor with a number of parties involved. World-trading related international organizations have suggested that Single Window (SW) be used as a means to make the trading process simpler and smoother. However, since each firm has its own requirements and objectives with SW, yet there is no consensus as to what traits of 'good' Single Window are. This study uses IT appropriateness as a determinant to explain an impact on information systems success. Historically, IS success was understood as multi-dimensional constructs such as use and performance. In this study we propose another dimension, continuance, and investigate the relationships among these outcome constructs.

Keywords : Single Window, IT Appropriateness, IS Success, Continuance

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1. Introduction

Global trading is an intrinsically complex endeavor with a number of parties involved. Lots of information controlling the flow of goods are exchanged among the parties. Today, due to an increased speed which is required for rapid business cycle, we need to execute its process with more speed and security.

To that end there had been many different information technology approaches. An earliest attempt was a customs automation system. It thereafter evolved into a trade information portal and further into a trade information exchange portal. In 2004 United Nations/Center for Trade Facilitation and Electronic Business (UN/CEFACT) has proposed an ambitiously innovative means, Single Window. It is defined as “a system that allows parties involved in trade and transport to file trade-related information in computer-readable form once at a single entry point to fulfil all trade and transit-related regulatory requirements” [UN/CEFACT, 2004].

At the very first the Single Window system had been launched by fast-mover countries such as Singapore, Hong Kong, and Republic of Korea. Thereafter, many other countries have followed these fast-movers and nowadays most of the remaining countries are implementing or planning to implement it.

As a matter of fact, this Single Window system takes many different forms. Some countries have a Single Window linking all relevant government agencies while some others' Single Window has linked only a portion of the gov-

ernment agencies. Among 49 countries which introduced a Single Window, according to World Bank's 2012 survey, only 20 were found to have the fully-linked Single Window [World Bank 2012].

In fact, there can be different types of Single Window in a single country. Korea, for instance, has two different Single Window systems. One is Customs-Centric Single Window system run by Korea Customs Service. The other is an integrated Single Window system built and operated by a private firm. A firm can choose one of the two, depending upon its own requirements and objectives [Tsen, 2011].

We believe that it is now a good time to come to provide kind of guidance or recommendations as to traits of 'good' Single Window and how these traits influence its outcomes. Though a number of academic studies were made on supply chain management (SCM) [Burgess et al., 2006; Giunipero, et al., 2008], one may hardly find an academic and empirical study on Single Window. SCM system and Single Window bear much similarity in a sense that both of them are designed to manage material and information flow among the parties in an interconnected chain. However, they are distinctive in that Single Window is a government lead project and SCM is a privately initiated practice.

In this regard we aim to elicit qualifications for a 'good' Single Window and to determine empirically the impact that such qualifications have on the use and outcomes of Single Window.

2. Literature Review

2.1 Single Window

Trade facilitation has been a key issue in international community. International organizations such as WTO, OECD, World Bank and UN have made an effort to make the trading process simpler and smoother. A number of aspects were discussed and studied, including the cost-benefit analysis of trade facilitation and ICT innovations for trade facilitation [OECD, 2009].

In 2004 the concept of Single Window was recommended for trade facilitation by UN/CEFACT. A Single Window is an electronic system that allows traders to file information once at a single entry point to fulfill all trade-related regulatory requirements [UNECE, 2002]. This Single Window can be implemented in three different ways [Yasui and Engman, 2009]. The first is an intermediary system which allows one agency to receive information and disseminates this information to all relevant agencies or parties. Sweden and Netherlands are operating this model. The second model is a gateway system that enables traders to communicate with different systems of different government agencies. This model is operated by Singapore and Mauritius. An automated and integrated transaction system is the last. In this case, traders are allowed to submit the standardized data only once to the system and then the system distributes the data to all relevant agencies and performs electronic processing and approval. Japan and Korea's system fall into this category.

Each country has its own requirements and objectives with Single Window. For instance, though the European Union has come to have a common e-customs standardized solution, the adoption is different from one member country to another [Raus, 2009]. Tsen [2011] analyzed recent trends in Single Window developments for countries all over the world and found that their requests for proposals (RFPs) are wide ranging depending upon the continent. They are dissimilar depending upon the continent. Even though the countries are in the same continent, their requirements differ from one region to another. In the future linking these different forms of Single Window into a global network will remain a great challenge in the future [Tsen, 2011].

Despite a few reports to provide general features for Single Window, there has been no academic study on qualifications of Single Window. We are interested in identifying characteristics of a good Single Window. In other words, we believe that these characteristics would be a great aid to other countries which have not implemented it yet but are currently planning to implement it.

2.2 Inter-organizational Information Systems

An inter-organizational information system (IOIS) is an information system operated jointly by two or more organizations. A good example of IOIS is a supply chain management (SCM) system. IOIS has been diffused greatly in business community since the introduction of new information and communication technologies such

as EDI or internet.

For the same reason, it became a major topic of many academic researchers from various disciplines such as logistics and transportation, operations management, materials distribution management, marketing and strategy, and information technology [Gunipero et al., 2008]. In fact, there have been a great number of IOIS studies. Despite their great volume, the literature was found to have limitations of being fragmented or little theory-based [Burgess et al., 2006; Gunipero et al., 2008].

Recently, with an aim to make the IOIS field be more theory-oriented, a few studies attempted a literature analysis study [Chatterjee and Ravichandran, 2004; Burgess et al., 2006; Gunipero et al., 2008]. Gunipero et al. [2008], through a review of 10-year SCM literature, classified SCM subjects into 13 categories. These include SCM strategy, SCM challenges, inter-firm relationships, e-commerce, quality, outsourcing, buyer behavior, and human resource management. Burgess et al. [2006] reviewed major constructs used in SCM literature to find that process improvement orientation and inter-organizational relationships are two mostly addressed topics.

The above result shows that IOIS studies mainly focused on business domain topics. For instance, they are concerned with how to integrate SCM strategy into the overall firm strategy or how to manage inter-organizational relationships with suppliers or partners.

In comparison, the Single Window is distinct from average inter-organizational information systems in some respects. First, it is driven

mainly by government agencies while average IOIS is usually established by business firms. Second, while with SCM business firms are able to make their own decision as to whether to join the SCM network and under what conditions to link with other firms or agencies each other, the Single Window does not give a firm or government agency that sort of freedom. The Single Window's adoption or use is more compulsory rather than arbitrary.

2.3 Utilization and Outcomes of Information Systems in Organizations

In modern organizations an information system has become one of the basic essentials. Almost of all firms adopt and make use of it for their own objectives such as being competitive against rival firms. As information system becomes an indispensable element to enhance organizational effectiveness, firms have come to reflect upon organizational design issue associated with the use of information system.

With organizational design there are many theories. One most often used theory within management community is structural contingency theory. This theory claims that there is no best way to organize or manage a firm and instead 'good' organizational structure and management ideas are contingent upon the organizational context, external or internal. At the very first, Woodward [1958] argued that technology is an important contingency factor and therefore an appropriate organizational design is contingent upon different technologies used. Besides technology, a number of contingency

factors such as degree of environment uncertainty, organization size, and strategy, were identified [Chandler, 1962; Lawrence and Lorsch, 1967].

An underlying premise of structural contingency theory is that, if the organization is to perform well, the organization should be designed in such a way that it best fits a set of contingency factors. Despite its popularity in the study of organizational design [Meyer, 1978], the contingency theory had been pointed out to have its ambiguity of fit and lack of theoretical basis [Schoonhoven, 1981; Tosi and Slocum, 1984; Venkatraman, 1989]. In this regard, Van de Ven and Drazin [1985], in a bid to develop the theory, classified the fit into three different conceptual approaches: selection, interaction, and systems [Drazin and Van de Ven, 1985]. Assuming that an organization must adapt to its context to survive or perform well, the selection approach focus on how single contextual factors affects a particular organizational structural characteristics. The interaction approach is to explain variations in organizational performance with the interaction of organizational structure and context. With the systems approach, fit is the degree of internal consistency among multiple contingencies and structural and performance characteristics.

This concept of fit has been used as a theoretical framework by many information systems researchers [Raymond, 1985; Ariav and Ginzberg, 1985; Goodhue and Thompson, 1995]. However, these studies were found to be weighed toward a too simplistic concept of fit. Through an extensive IS literature analysis, Livari [1992]

pointed out that IS studies relied much on the selection approach and called for taking the systems approach to obtain a more complete understanding of the context-IS characteristics-effectiveness relationship.

Coming up to the expectation, Khazanchi [2005] suggested 'IT appropriateness' as a construct to model the systems approach to 'fit.' Based on the Van de Ven and Drazin[1985]'s view of the systems approach, Khazanchi has defined 'IT appropriateness' as the fit between current business conditions and characteristics of technology in determining whether a firm is to adopt/ implement a new IT.

An appropriately designed and deployed IT or system is expected to achieve what to be attained originally. We call it as information systems success. IS success has been studied as a key dependent variable by many IS researchers. DeLone and McLean [1992] classified IS success into three broad categories : technical level, semantic level, and effectiveness. Technical and semantic level of success are represented as the quality of the system and the quality of information provided by the system, respectively. Effectiveness which is denoted as the effect of the information on the user is usually measured by use and net benefits [DeLone and McLean, 1992, 2003]. Here, net benefits is denoted as organizational performance or outcomes. Delone and McLean [1992] further asserted that there is an influencing relationship among these success criteria. System or information quality are to exert an influence on the system use which itself influences organizational performance [DeLone and McLean, 1992,

2003; Limayem and Cheung, 2008].

Among the above effectiveness measures is the most often employed in IS studies the system use [Tornatzky and Fleischer, 1990; Davis, 1989]. The use was mainly first-time use. Apart from initial acceptance or use of IS, long-term viability of IS has been also recognized as its role in today's business is getting more critical. Lyytinen and Hirschheim [1987] claimed that a long-term use of an ineffective IS may lead to corporate failure. In this regard, Bhattacharjee [2001] proposed the continued use or continuance as a new research construct. Many of subsequent studies have used the continuance as a key dependent variable. For instance, the continuance of e-learning [Limayem and Cheung, 2008; Roca et al., 2006], online banking [Vatana-sombut, 2008], and electronic textbook [Stone and Baker-Eveleth, 2013] was addressed.

3. Research Model and Hypotheses

Our study aims to give an answer to what are traits of a 'good' Single Window or what is meant by a successfully deployed Single Window. Academic community of management, long before, has used the concept of fit to explain a well-designed organization [Woodward, 1958; Galbraith, 1982]. It signifies that, for an organization to perform well, the organization needs to be designed to in such a way that context and structure fit together [Drazin and Van de Ven, 1985].

In fact, the context-structure-performance relationship is not monolithic. Asserting that there exist multiple contingencies, multiple struc-

tural characteristics, and multiple performance criteria in a modern organization and they are simultaneously and reciprocally interacting, Drazin and Van de Ven [1985] suggested that these elements be considered holistically. It was named as the systems approach to 'fit' by Van de Ven and Drazin [1985].

It is strongly recommended that IS researchers apply the systems approach to fit in ever-increasing numbers [Livari, 1992]. IT appropriateness was proposed as a construct to model the systems approach to fit [Khazanchi, 2005]. With the construct, we are able to determine how IT is deployed and utilized in the organizational context [Kim et al., 2013; Peterson and Howard, 2012]. In more specific, our study views the IT appropriateness as the extent to which an organization's business conditions, and the nature of Single Window, and its performance criteria fit together.

IT appropriateness is a hypothetically existing construct and is not directly observed. We view that IT appropriateness composes three observed variables. First is internal/external business environment variable, which we define as the extent to which use of Single Window is plausible and smooth in a given industrial sector and to which internal business processes and systems are adaptable to Single Window [Khazanchi, 2005]. Partner relationship is the second component of IT appropriateness. We define partner relationship as the degree of relatedness an organization develops with its partners [Chen and Paulraj, 2004]. Finally, data usefulness defined as the extend to which the data exchanged give benefit to business oper-

ations is the third component. The importance of information quality in SCM practice was indicated by Zhou and Benton [2007].

Reflecting the above analysis, our research model is given as in <Figure 1>. IT appropriateness is believed to provide a positive impact on not only its utilization and performance, as suggested by Khazanchi [2005]. A number of IS studies have implied that increased utilization will positively influence performance [Goodhue and Thompson, 1995; Petter et al., 2008; DeLone and McLean, 1992, 2003].

Some IT users discontinue to use IT after an initial acceptance. So, continuance rather than an initial use would be a more optimal goal. Though IS researchers have used continuance as an important dependent variable [Bhattacharjee, 2001; Limayem and Cheung, 2008], the continuance has not been used as one of IS success criteria. We assert that the continuance may be one of IS success constructs and will be influenced by utilization and performance. <Figure 1> shows our research model.

Based on the research model, a number of research hypotheses can be derived, as shown in <Table 1>.

<Table 1> Research Hypotheses

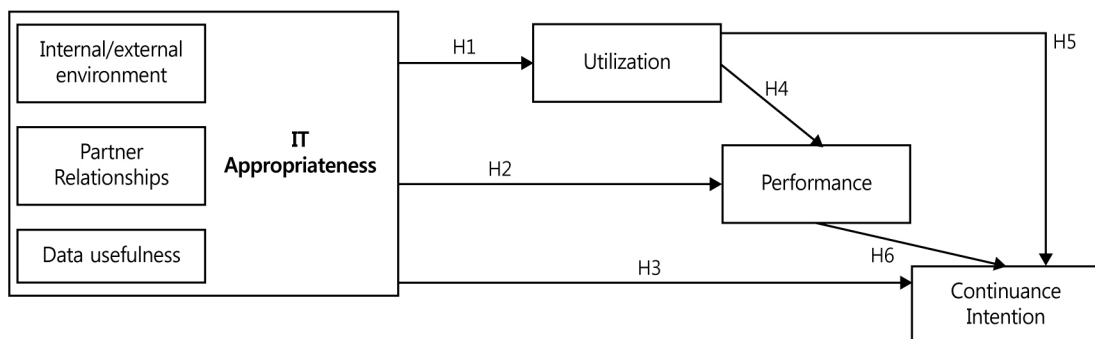
H1	<i>IT appropriateness will positively influence utilization.</i>
H2	<i>IT appropriateness will positively influence performance.</i>
H3	<i>IT appropriateness will positively influence continuance.</i>
H4	<i>Utilization will positively influence performance.</i>
H5	<i>Utilization will positively influence continuance.</i>
H6	<i>Performance will positively influence continuance.</i>

4. Research design

We below describe in brief about the instrumentation, sampling method, and scale validation process.

4.1 Instrumentation

Our instrument was constructed by taking and adapting scales from previous studies and by constructing new scales where necessary. Continuance item were brought from Bhattacharjee [2001]. Performance items were adapted from Koh et al. [2007], using 4 items. Utilization was newly constructed based on 31 major function-



<Figure 1> Research Model

alities of Single Window. With variables for the latent construct, IT appropriateness, internal/external environments were adapted from Khazanchi [2005] using 5 items, partner relationships were Chen and Paulraj [2004] using 3 items, and data usefulness was constructed using 3 items by adapting McGowan [1998] and Zhou and Benton [2007]. And, each item was measured using a 7-point Likert scale. Appendix A shows the measurement items.

4.2 Data Collection

To collect data for our study, a questionnaire survey was administered in Korea. A mailing list of Single Window user firms compiled by Korea Customs Service was used. The list consists of exporters/importers, licenses customs agencies, warehouse operators, carriers, freighters, and landing agencies. We received 231 response. With incompletely and inconsistently answered questionnaires of 73 excluded, the study used 158 samples for the analysis. With such a high rate of excluded questionnaires, we infer at least two reasons. One is that the number of questions of the survey is too large. For instance, to measure the level of SW utilization, it had 31 questions, each question for a specific individual function of SW. Besides, one of the items to measure continuance was phrased in the semantically opposite direction.

5. Data Analysis and Results

5.1 Reliability and Validity

For validity analysis, factor analysis was

used. <Table 2> shows the results.

The 18 items all have met the criteria with $SFL \geq 0.50$. All of their Cronbach's alpha values also met the criteria $\alpha \geq 0.70$, as shown in Table 1. And, to test convergent validity, average variance extracted (AVE) was used. AVE values of all 5 constructs ranged from 1.03 to 1.24, meeting the criteria $AVE \geq 0.50$.

<Table 2> Validity of Constructs

	component					Cronbach's alpha
	1	2	3	4	5	
IE1	.844					.907
IE2	.838					
IE3	.794					
IE4	.762					
IE5	.742					
PR1		.944				.913
PR2		.900				
PR3		.871				
DU1			.847			.946
DU2			.867			
DU3			.854			
PE1				.862		.942
PE2				.846		
PE3				.788		
PE4				.785		
CO1					.894	.909
CO2					.867	
CO3					.874	

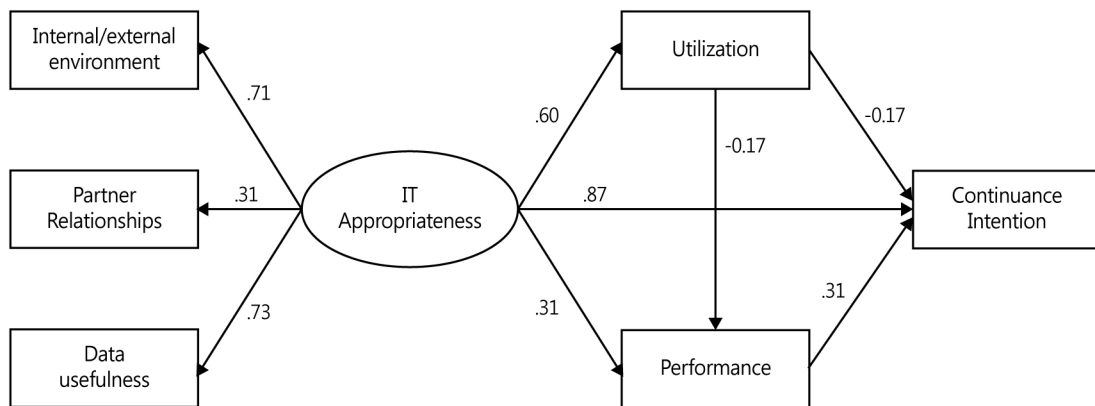
5.2 Structural Equation Modeling

Our research model was tested by structural equation modeling using AMOS with maximum-likelihood estimation. In structural equation modeling, model fit is indicated by various indices. As shown in <Table 3>, all model fit indices met the recommended criteria.

<Table 3> Reported Values of Model Fit

Model Fit Index	Recommended Values	Reported Values
X2	$p \geq 0.05$	6.629
X2/df	≤ 3.00	1.105
GFI	≥ 0.90	.987
AGFI	≥ 0.80	.954
NFI	≥ 0.90	.973
CFI	≥ 0.90	.997
RMR	≤ 0.09	.051
RMSEA	≤ 0.10	.026

An analysis of causal relationships in the research model is next. <Figure 2> shows its results with estimated path coefficients. And <Table 4> shows results of hypotheses testing



<Figure 2> Results of Structural Model Analysis

<Table 4> Hypotheses Testing Results

	Hypothesis	Std. path coeff.	C.R.	accept
1	IT appropriateness will positively influence utilization.	.599***	5.885	o
2	IT appropriateness will positively influence performance.	.874***	5.830	o
3	IT appropriateness will positively influence continuance.	.315*	1.444	o
4	Utilization will positively influence performance.	-.172	-1.603	x
5	Utilization will positively influence continuance.	-.046	-0.422	x
6	Performance will positively influence continuance.	.306**	1.955	o

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

with C.R. value. As expected, IT appropriateness shows having a positive impact on all IS success constructs, utilization, performance, and continuance intention. With respect to the relationships among IS success constructs, we find that utilization influences positively neither performance nor continuance. However, performance has a positive impact on continuance intention.

6. Conclusion

In recent times a great number of parties involved in global trading are required to deploy and utilize Single Window. This paper aimed to

elicit qualifications for a 'good' Single Window and to determine empirically the impact that such qualifications have on the use and outcomes of Single Window.

Our study results show that IT appropriateness can be a meaningful determinant for IT success constructs. When it comes to defining a 'good' Single Window, we may state that it ought to be designed fitting with internal/external environment, partner relationships, and data usefulness. And, we have found that continuous use of IT can be determined by performance.

We argue that not only theoretical but also practical implications would be made from this study. They are described below, respectively.

MIS literature used utilization as a key outcome construct. There have been many theories developed to explain the utilization of a system with a premise that, once the system is used, it would lead to a positive outcome. TAM, TAM2, UTOUT models all belong to this type of theory. However, our study results are unlikely to support this claim. That is, utilization does not necessarily guarantee continuance. Instead, the performance or outcome that will acquire from use of the system can explain more as to whether to continue to use or not.

Our study shows that IT appropriateness can explain all outcome constructs such as utilization, performance, and continuance. It can be asserted that it has a strong implication practically. When you design or market a system, it is important for the system to be fit between current business conditions and characteristics of technology.

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<Appendix A> Constructs and Measurement Items

Internal/external environment	IE1 Our firm is requested to use Single Window (SW) by offshore partners. IE2 Our firm is requested to use SW by domestic partners. IE3 Our CEO continuously gives support when deploying/using SW. IE4 Our CEO is determined to use SW. IE5 Our CEO invests resources in IT to develop/use SW.
Partner relationship	PR1 Our firm is aligned with partners including logistic players. PR2 Your partner firm tends to accommodate your demand. PR3 Our firm is firmly partnered with logistic partners.
Data usefulness	DU1 SW provides real-time data. DU1 SW provides concrete data. DU1 SW provides data relevant to our business.
Utilization	UT1 To what extent our firm uses 'export custom clearance' function. UT2 To what extent our firm uses import clearance' function. UT31 To what extent our firm uses 'air-way bill advice' function.
Performance	PE1 Using SW improves cargo management. PE2 Using SW reduces our trading cost. PE3 Using SW cuts lead-time. PE4 Using SW enhances our cargo tacking ability.
Continuance	CO1 Our firm intend to continue using SW rather than discontinue its use. CO2 Our firm's intentions are to continue using SW than use any alternative means. CO3 If we could, our firm would like to discontinue our use of SW.

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